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ARMED FORCES CHEMICAL JOURNAL

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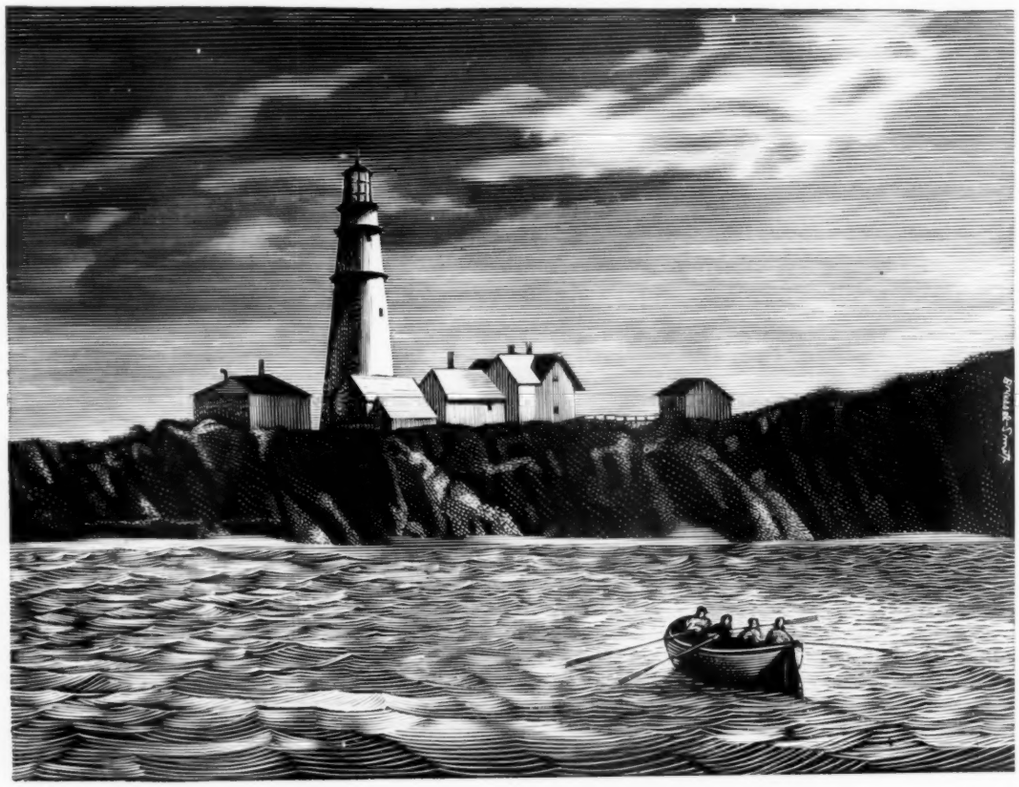
JULY-AUGUST, 1955

Tenth Annual Meeting Number



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ARMED FORCES CHEMICAL JOURNAL

OFFICIAL PUBLICATION OF THE ARMED FORCES CHEMICAL ASSOCIATION

SUITE 819, 2025 EYE STREET, N.W., WASHINGTON 6, D.C.

VOLUME IX JULY-AUGUST, 1955 NO. 4

COVER PHOTO

This inspiring picture was originally selected because of its special fitness to signalize the July issue of the JOURNAL as an Independence Day issue. It was not feasible to distribute the magazine by the Fourth of July, however, the picture is still in keeping with the spirit of the Cleveland meeting.

The Armed Forces Chemical Journal is the official publication of the Armed Forces Chemical Association. The fact that an article appears in its columns does not indicate the approval of the views expressed in it by any group or any individual other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors.

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INDEX

	Page
A.F.C.A.'s 10th Annual Meeting	2
A.F.C.A. Chapter Activities	42
Anthrax Vaccine, Award to Developer of, Dr. George C. Wright	24
Community Supports Armed Forces Day	24
Dr. David Bruce Dill, High Honor for	43
Directors-at-Large	8
Group and Sustaining Members	40
Reminiscences of World War I. ...*By* DR. E. EMMET REID	37
ROTC Students Receiving A.F.C.A. Awards	22
Science and Engineering Manpower Potential of the U. S. ...*By* MORRIS T. CARPENTER	30
Smoke Troops Get Emergency Training	10
Technical Manpower, Producing More ...*By* CLIFFORD F. RASSWEILER	25
Training the Future Top Management of the Army Supply System ...*By* COL. THOMAS B. EVANS	34
Uses of Technical Manpower, The ...*By* GUS C. LEE	18
What the Chemical Corps is Doing ...*By* MAJ. GEN. WM. M. CREASY	12

ADVERTISERS

Bastain-Morley Co., Inc.	29	Harshaw Chemical Co.	7
Columbia-Southern Chem. Corp.	iii	Niagara Alkali Company	ii
Diamond Alkali Company	11	Olin Mathieson Chem. Corp.	13
Dryden Rubber Division	33	Professional Directory	15
Ferro Corporation	19	Shell Chemical Corporation	21
General Tire & Rubber Co.	iv	Stauffer Chemical Company	39
Walter Haertel Company	27	Witco Chemical Company	17

Published bi-monthly—Jan.-Feb.; Mar.-Apr.; May-June; Jul.-Aug.; Sept.-Oct.; Nov.-Dec.—by the Armed Forces Chemical Association, located at National Headquarters, Armed Forces Chemical Association, Suite 819, 2025 Eye St., N. W., Washington 6, D. C. Entered as second class matter at the Post Office at Washington, D. C., under the Act of March 3, 1879. Additional entry at Nashville, Tenn. Subscription price $2.00 per year to members; $4.00 per year to non-members. Inquiries concerning circulation and advertising should be addressed to the Secretary-Treasurer.

★ ★ ★ ★ ★ ★ ★ A. F. C. A.'s 10th A

The A.F.C.A.'s 10th annual meeting, with the Army this year in the role of host, was held at the Hotel Cleveland, Cleveland, Ohio, on June 16-17. The registration was upwards of 200.

In the opinion of "old guard" members who have attended many, if not all, of the Association gatherings, this one deserves a place among the most successful and important. Much larger meetings have been held, but this one under the guidance of the General Committee on Arrangements, headed by Mr. Glenn Hutt, vice president of the Ferro Corporation and a vice president of A.F.C.A., was one of the smoothest from the standpoint of conformity to schedule and timing. Moreover, the General Committee, drawn principally from the Cleveland Chapter, had not only provided a diversified and entertaining program but one of substantial value in furtherance of the aims of the Association. As a herald of the meeting's success a gracious message had been received by A.F.C.A. president, Rear Admiral N. S. Prime, USN (ret.), from President Dwight D. Eisenhower. The message, which was printed in the souvenir program, was as follows:

"To the members of the Armed Forces Chemical Association—I send my greetings on the occasion of your annual convention. I congratulate all of you on the continuing efforts of the Association to help gear the vital work of the chemical industry to the requirements of our Armed Services. My best wishes go to your officers and delegates for another successful convention."

In addition, there were letters from top officials of the Defense Department and other government agencies and industrial organizations extending congratulations and best wishes to the Association on its 10th anniversary meeting. Among these were messages (all printed in the program) from Sceretary of Defense, Charles E. Wilson; Secretary of Commerce, Sinclair Weeks; Secretary of the Army, Robert T. Stevens; Secretary of the Navy, C. S. Thomas; Secretary of the Air Force, N. E. Talbott; Admiral Lewis L. Strauss, Chairman of the Atomic Energy Commission; Major General William M. Creasy, Chief Chemical Officer; Mr. William C. Foster, president of the Manufacturing Chemists Association, Inc.; and Mr. Samuel Lenher, president of the Synthetic Organic Chemical Manufacturers Association.

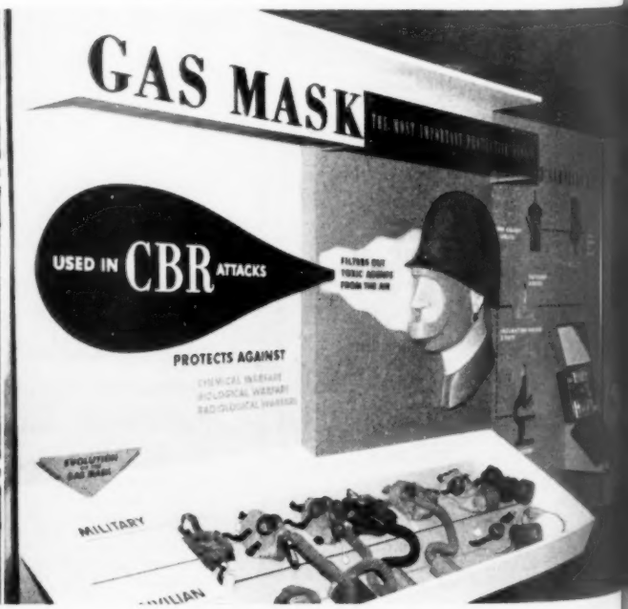
Space precludes reproducing all of these letters here; however, it seems especially appropriate to present the message from Secretary Stevens, accepting for the Army the role of host service. It was as follows:

"The Department of the Army considers it a privilege to serve as official host for the 10th Annual Meeting of the Armed Forces Chemical Association, which has been for a decade so valuable a channel of cooperation between the chemical industry and the military Services in the fields of research and development, procurement, and industrial mobilization planning. The Association truly reflects the splendid spirit of unity in defense that has ever been one of our Nation's great sources of strength. I congratulate its members on their past record of service to America, and look forward with confidence to many more years of fruitful cooperative effort. My very best wishes for a highly successful meeting in Cleveland."

The principal representative of the Army in its role of host at the meeting was the Chief Chemical Officer, General Creasy. Maj. Gen. C. E. Loucks, who until his retirement in May was Deputy to General Creasy, also attended as did many of the top-ranking officers of the Corps, including commanders of prin-

Chemical Corps Exhibit—Introductory panel featuring civilian defense against CBR attacks.

Chemical Corps Exhibit—Display of gas masks.



cipal Chemical Corps installations and procurement offices. Then, too, there was the elaborate, newly prepared Chemical Corps exhibit.

While good speeches have generally characterized A.F.C.A. meetings, those at this meeting were especially interesting and timely. As the meeting was originally planned, all of the speeches, not only that of Gen. Creasy, were to center more directly on strictly Chemical Corps activities and interests. However, a succession of conflicts of dates was encountered so that a somewhat different type of program was later decided upon. Those members who had some doubt as to whether the ever-important but much-discussed subject of technical manpower would prove an inspiring theme for the meeting were agreeably surprised. The addresses on this problem, in which the Association has long maintained an active interest, were outstanding not only as to content but as to the manner of delivery. Some brief references to these talks are made later in this article. However, each deserves to be read and studied and for that reason the speeches are presented in full in this issue.

Following, in a more or less chronological order, is an account of the various sessions and events of the meeting.

THE FIRST DAY

Except for the business meetings at night, the program of the first day was aimed largely at furthering acquaintances and enabling members to renew old associations. It opened with a coffee hour, a stand-up gathering in the Rose Room, which brought forth a good number of the early arrivals. There was plenty of time to look over the Chemical Corps exhibit before the next event and many took advantage of this opportunity.

Chemical Corps Exhibit

A newly fabricated exhibit pertaining to the CBR (chemical, biological, radiological) functions of the Chemical Corps and emphasizing especially civilian protection against such forms of warfare was brought to Cleveland for the A.F.C.A. meeting. This was the first showing. A special detachment of Chemical Corps personnel, headed by Colonel Joseph F. Escudé, was in charge. The exhibit, which was open to the general public, consists of a series of panel displays with elaborate lettering in various colors and includes a number of outsize photographs of chemical munitions and panoramic representations of field operations involving Chemical Corps equipment. The entire set of panels is provided with a special lighting system. One of the displays is a progressive series of colored charts illustrating the physiological disturbances caused by nerve gas and the nerve function-restorative effects of the drug, atropine, when promptly administered. There also are panels showing developments in the design of gas masks, flame thrower operation and smoke equipment development. The entire exhibit is of considerable size and in view of the limitation of available space at the hotel only about half of the various display panels were set up. In addition to the new panel exhibit there was a display in an adjoining room of various chemical munitions, including an airplane fire bomb, smoke generator, sectionalized smoke shells and fuses, etc. In the main lobby of the hotel opposite the principal entrance there was a very effective panel signalizing the A.F.C.A. meeting. It contained a panoramic aerial view of the city of Cleveland over which circular zones were marked to indicate areas of various types of vulnerability to atomic attack. Lettering underneath the picture called upon the viewer to press a button and when he did, the outer circular zone was obscured by light shading to represent the possible use of smoke to minimize the heat effects from an atomic explosion.

ANNUAL MEETING ★ ★ ★ ★

—Photographs by U. S. Army

Chairman Glenn Hutt of the General Committee on Arrangements and some of his staff at the meeting headquarters, Hotel Cleveland. Left to right, Col. Harry A. Kuhn, Mr. Russell Frank, Mr. Russell A. Lawson, Mrs. Glenn A. Hutt, Mr. Hutt, Colonel O. D. Kenworthy, Mrs. Lawson, and Mr. George Boehm.

One of the tables at the annual banquet. Clockwise, commencing with Mr. Wallace M. Adache (holding his napkin) of Adache & Case, Engineers; Col. Cowan, Ohio Bell Telephone Co., U. S. Air Force Reserve Wing Commander, Northern Ohio; Mr. James A. Sedgwick, American Steel and Wire Co.; Mrs. Oliver F. Johnson; Mr. Harry A. Wansker, United-Carr Fastener Corp., Cambridge, Mass., fifth vice president of the A.F.C.A.; Dr. Ralph E. Gibson, Director, Applied Physics Laboratory, Johns Hopkins University, Silver Spring, Md., first vice president of A.F.C.A.; Mr. Bruce E. Colewell of Adache & Case; Mrs. Adache; Mr. Oliver F. Johnson, Design Engineer and sixth vice president of A.F.C.A.; and Mrs. Sedgewick.

Admiral Prime (left) presenting the A.F.C.A. Saftey Award Plaque to Col. Donald D. Bodé, Commanding Officer, Dugway Proving Ground, Dugway, Utah, at the general meeting of the Association on the morning of June 17.

Scene at reception: at left, Mrs. N. S. Prime, wife of Admiral Prime, and their daughter, talking to Mr. H. A. Wansker, fifth vice president; in center, Mr. Charles F. Pledger, general counsel; at right, President Prime discussing messages received with Mr. Lew Terry, immediate past president of the Midwest Chapter.

Marine Corps Color Guard of Honor, 11th Infantry Battalion, USMCR, Cleveland, Ohio, at A.F.C.A.'s 10th annual meeting and special Chemical Corps Exhibit banquet. Left to right, Sgt. Herbert C. Reblin, S/Sgt. D. Kreakie, S/Sgt. R. Montanaro, and Sgt. K. Gronert.

Visit to Nela Park

At 11:00 A.M. visiting members and guests took special buses for a visit to Nela Park, the electric-lighting research and development establishment of the General Electric Company. The trip led through the campus of Western Reserve University and along the lake front. The park area is of historical interest to the Chemical Corps as the site of the so-called "Stockade" in World War I where the toxic agent Lewisite was manufactured. The A.F.C.A. group had a box luncheon served at tables outside the Nela Park Clubhouse and afterward the visitors were taken to the lighting display buildings. The presentation there consisted of demonstrations of good and bad lighting effects for schools, offices, home interiors, and department stores, including window displays. There was also an exhibit showing every conceivable sort of incandescent and fluorescent light fixture ranging from the tiniest surgical instrument light to an enormous globe rated at 75,000 watts, said to be the largest in the world. Visitors needed no persuasion of this, and readily responded to the company representative's admonition to turn their backs to the lamp when it was turned on, as it produced not only a tremendous light suggestive, one might say, of the atomic fireball, but also considerable heat. Following the lighting demonstrations, which were ably conducted by personnel of the establishment, the A.F.C.A. visitors returned to the hotel.

TV Presentation

The press of Cleveland evidenced considerable interest in the meeting, and during the day there were a number of press interviews with the A.F.C.A. president, Admiral Prime, and other Association officials. At 6:30 P.M. President Prime, accompanied by Major General Charles E. Loucks, USA (retired), one of the newly elected Directors-at-Large, appeared on a TV news program. In response to questions, Admiral Prime explained the organization and purposes of the Association, noting particularly its role in furthering National Defense by promoting understanding and friendly relations between the Armed Forces and the chemical industry.

Directors' Meeting and Election of Officers

At the meeting of the Board of Directors, held at 8:30 P.M. at the Hotel Cleveland, President Prime, presiding, gave a brief review of the Association's activities during the past year. Secretary-Treasurer O. E. Roberts, Jr., presented the financial statement, which was approved. In a general discussion of financial affairs it was pointed out that up to the present the fiscal objective of the Association has been to establish a moderate reserve as a cushion in case of a serious slump in revenues.

Opinion was expressed that the matter of the Association's fiscal policy and objective might now be re-studied and a motion to that effect was adopted.

A proposal to adopt as a technical manpower policy, "grass roots" support of science and mathematics in secondary schools, was returned to the Executive Committee to develop a complete program for consideration at the next directors' meeting.

There was considerable discussion on the subject of agenda and procedures for meetings of the Board of Directors. This resulted in the adoption of a motion to direct that henceforth no matter of a controversial nature will be brought before the Board of Directors unless it has been considered and a recommended course of action respecting it has been decided upon by the Executive Committee.

Admiral Prime was re-elected president of the Association for the ensuing year, and also all of the other officers were re-elected except in the case of the second vice president. Colonel Robert T. Norman, USAR, who had long served as the second vice president and chairman of the Finance Committee, had given notice that he did not desire to continue in office, but would be willing to continue to serve in an advisory capacity on financial matters. Accordingly, for this position, Brigadier General Clifford L. Sayre, USAR, of the Becco Chemical Division, Food Machinery and Chemical Corp., Buffalo, N. Y., had been selected by the Nominating Committee, headed by past president Louis W. Munchmeyer, and along with the others on the slate presented to the Directors, General Sayre was unanimously elected.

A.F.C.A. Industrial Advisory Council

Before the directors' meeting on the night of June 16 a meeting was held of the newly organized Industrial Advisory Council of A.F.C.A., consisting of representatives of chemical and allied industries.

As later announced at the General Meeting on June 17, the purpose of this group is to conduct, as appropriate, studies of industrial problems bearing upon defense-item procurement and to be prepared to make recommendations.

Mr. Simon Askin, president of the Heyden Chemical Corporation and president of the New York Chapter of A.F.C.A., was elected chairman of the Council.

General Creasy addressed the meet-

President Prime presiding at the annual banquet. The picture shows some of the others at the speaker's table. At left, Colonel Frank E. Hoffman, U. S. Air Force; General Creasy; at right, Mr. R. F. Baldaste, and Dr. Per K. Frolich of the Chemical Corps.

Dr. H. F. Johnstone, head of the Department of Chemical Engineering, University of Illinois, receiving the Army's Exceptional Service Decoration, presented by General Creasy during the banquet at the 10th annual meeting.

Directors' Meeting—group of early arrivals snapped before opening of the meeting. Left to right (standing), Mr. Russell Lawson, Mr. Wm. B. Plummer, Dr. Per K. Frolich, Mr. Louis W. Munchmeyer, Col. Bruce T. Humphreville, Mr. Simon Askin, Mr. Al Brown, Mr. K. G. Irving, Brig. Gen. Clifford L. Sayre, Col. Geo. W. Dorn, and Lt. Col. O. E. Roberts, Jr. Seated, Mr. W. D. Wilkinson, Mr. H. A. Wansker, Admiral Prime, Dr. Ralph E. Gibson, Mr. Oliver F. Johnson, and Col. Harry A. Kuhn.

ing, expressing his appreciation of the interest of the Association in Chemical Corps problems.

SECOND DAY

General Meeting

The program of the second day also opened with a coffee hour gathering. This was followed by the General Meeting at 10:00 A.M. in the main ballroom. Admiral Prime, in opening the session, welcomed the guests and expressed thanks to the General Committee on Arrangements, headed by Mr. Hutt, and to the Cleveland Chapter. He noted appreciation of the sponsorship of this meeting by the Army in the role of "host service." It is now established practice to so call upon one of the three Armed Services each year. Last year the Air Force was host and in 1956 for the meeting in Boston the Navy is sought for the role. Admiral Prime next reviewed briefly the work of the National Headquarters during the past year. He noted that 210 additional members had been enrolled, although the number of group memberships remained practically unchanged. He emphasized the importance of individual efforts by members to aid the Association, both as to membership and support of Association publications through advertising. He stated that the finances of the Association showed some gain for the year as a result of the 1954 meeting receipts. Announcement was made of the election results at the directors' meeting and the membership was also informed of the organization of the Industrial Advisory Council as an agency of the Association prepared to advise the Chemical Corps on industrial matters if requested.

Sixth Vice President Oliver F. Johnson, who heads a special subcommittee making a re-study of the Association's ROTC award program, addressed the meeting, stating that he expected an early report on this would be made to the Executive Committee. He outlined a number of proposed procedures with respect to the award program which he said were under consideration for submission to the Executive Committee. The primary purpose of this re-study is to formalilze the award procedures in conformity with the enlarged program of the Association in this matter and changes in the ROTC establishment itself since the program was inaugurated some years ago.

Admiral Prime made reference to the recent death of Dr. Gustav Egloff, distinguished scientist and Director-at-Large of the Association, and expressed the deep regret of the Association in this loss. Admiral Prime also informed the Association of the illness of Dr. Walter E. Lawson, past president, who recently suffered a stroke but who now is reported to be improving. He extended on behalf of the Association best wishes to Dr. Lawson for a speedy recovery.

He spoke also of Mr. Fred Jacobs, former secretary-treasurer, who retired last year because of health, stating Mr. Jacobs is holding his own, and visits A.F.C.A. headquarters from time to time.

The next event on the morning program was the presentation to Dugway Proving Ground of the Chemical Corps, Dugway, Utah, of the Safety Award of the A.F.C.A. in the form of a bronze plaque. Colonel Donald D. Bodé, commanding officer of the Dugway Proving Ground, was present and accepted the award. In addition to the A. F. C. A. presentation, Dugway was also honored this year as winner of the National Safety Council Award. This award, also represented by a bronze plaque, was received by General Creasy and presented by him to Colonel Bodé, who expressed appreciation for both of these honors on behalf of the personnel of Dugway. Both of these awards were made on the basis of improvement in the safety record for the year 1954 as compared with the previous year.

At the cocktail party (left to right) Lt. Col. Frederick J. Hurley, New York Chemical Procurement District; Gen. Loucks; Brig. Gen. John R. Burns, Commanding, Army Chemical Center, Md.; Col. Harry A. Kuhn, USA (ret.); and Mr. Al Brown, president, New England Chapter.

Note was taken of a written report on activities of the Midwest Chapter during the previous year, prepared by the chapter's immediate past president, Mr. Lew Terry. General Creasy, Admiral Prime, and others spoke of the outstanding record of this chapter for constructive accomplishments. In this connection, Mr. Thomas E. Sharp, second vice-president of the Midwest Chapter, was called to the platform and presented a framed scroll by the Association in ap-

preciation of his work for the organization. Following these ceremonies the meeting was declared open for general discussion. Among the speakers during this period was Mr. W. D. Wilkinson, third vice president, who spoke of the military procurement and industrial relations surveys made by Midwest Chapter.

Afternoon Speeches

GENERAL CREASY

The afternoon session, with Admiral Prime presiding, opened with a speech by General Creasy entitled, "What the Chemical Corps Is Doing." General Creasy, referring to his speech as a "report to the stockholders," reviewed some of the organization problems of the Corps and also spoke of its utilization of scientific personnel.

General Creasy, Chief Chemical Officer, addressing the afternoon session on "What the Chemical Corps Is Doing."

In commenting on his speech, which, with others at the afternoon session, is presented in full herein, Admiral Prime noted that it served well to lay a foundation for the talks which were to follow.

MR. GUS C. LEE

The next speaker was Mr. Gus C. Lee, from the office of the Assistant Secretary of Defense Carter Burgess (Manpower and Personnel), who spoke on the "Uses of Technical Manpower." Mr. Lee, with respect to shortages of technical manpower, observed that one solution might be to find some means of assuring that a greater percentage of science and engineering graduates followed the occupation for which their college training presumably fitted them. He also suggested that perhaps the requirements for engineers might be reduced by providing more technicians to assume part of the workload of engineers, as in the case of the medical profession.

Mr. Gus C. Lee, Director, Manpower Utilization Office, Office of the Asst. Secretary of Defense (Manpower and Personnel), speaking at the afternoon session on June 17.

DR. RASSWEILER

Dr. Clifford L. Rassweiler, vice chairman of the Board, Johns-Manville Corp., was the third and final speaker of the afternoon. He said he did not share the "optimism" of Mr. Lee on the technical manpower situation, declaring that a critical shortage of such manpower is a problem which has been with us for 15 years. He noted that no one realized this more than those representatives of industry who must compete in the open market for their services of new engineering graduates. Dr. Rassweiler emphasized a new approach for developing scientific and engineering personnel. It is now realized, he said, that a start on solution of the problem must be made at the high school level and measures adopted to insure adequate interest in mathematics and science on the part of students. Special inducements such as scholarships may be necessary to bring this about, he said.

Dr. Clifford R. Rassweiler, Vice Chairman of the Board, Johns-Manville Corporation, tells of seriousness of the technical manpower shortage at afternoon session on June 17.

With respect to technical manpower utilization, Admiral Prime pointed out that the A.F.C.A., in its stand on the matter, does not seek to deprive young men of an opportunity to serve in the Armed Forces. He said the Association does, however, stand for measures to insure the necessary number of such personnel for both the military establishment and industry.

President's Reception and Annual Banquet

The president's reception and cocktail party took place at 6:30 P.M. in the Red Room. The banquet which followed was held in the mezzanine ballroom. Approximately 250 members and guests were present. The program opened with presentation of the colors by a Marine Corps color guard of honor from the Cleveland Marine Training Center and the singing of the National Anthem. The invocation was given by the Rev. Kenneth R. Hoffmann, Grace Lutheran Church, Cleveland Heights, Ohio.

The guest speaker for the evening was Mr. R. F. Baldaste, Administrative Director of the Whiting Laboratories, Whiting, Indiana, of the Standard Oil Company (Indiana). Mr. Baldaste represented Mr. Morris T. Carpenter, Executive Director of the Standard Oil Laboratories, who, due to illness, was unable to attend. Mr. Baldaste ably presented the address which had been prepared by Mr. Carpenter. Mr. Baldaste had arrived in time to attend the afternoon session of the Association, and by way of a connecting reference, he called attention aptly to the similarity of views on the need for a high school

Mr. R. F. Baldaste, Administrative Director, Whiting Laboratories, Standard Oil Company (Indiana), addressing the banquet gathering of the A.F.C.A. at the Hotel Cleveland on June 17.

level approach to the scientific manpower problem expressed in the afternoon by Dr. Rassweiler and those contained in Mr. Carpenter's address.

The Exceptional Service Decoration, the highest civilian award given by the Department of the Army, was presented at the banquet to Dr. H. F. Johnstone, head of the Department of Chemical Engineering, University of Illinois. General Creasy, representing the Secretary of the Army, made the presentation of the award, which consists of a bronze medal and a scroll. The citation noted the long and distinguished service of Dr. Johnstone as consultant and scientific advisor of the Chemical Corps and the Department of Defense.

Admiral Prime took occasion at the banquet to extend the congratulations of the Association to Chairman Hutt of the General Committee on Arrangements for the meeting, to Mr. Robert Cutler, president of the Cleveland Chapter, Mr. Harry A. Wansker, fifth vice president and chairman of the Meetings Committee of A.F.C.A., and Colonel Harry A. Kuhn of Washington, D.C., who assisted with the program, and to call upon them to "take a bow."

In response to a request, Mr. Wansker, who is a member of the New England Chapter, gave a brief preview of what New England has in store for the Association in June 1956 when the annual meeting will be held in Boston with the Navy as host service.

While the program generally was in a serious vein, there was a surprise entertainment feature. This was a humorous monologue in the form of a pseudo-scientific dissertation on atomic energy and other scientific matters by a comedian, Mr. Henry Pildner, appearing as "Dr. Barton."

Seated at the speaker's table in addition to Admiral Prime was Mr. John Porkorny, Cleveland's Director of Civil Defense; Colonel Frank E. Hoffman, Chief, Air Procurement District, Cleveland; General Creasy; Mr. Baldaste; Dr. Per K. Frolich, Chief Scientist of the Chemical Corps; Dr. H. F. Johnstone, head of the Department of Chemistry, University of Illinois; Vice Admiral Frank A. Leamy, Commander, 9th Coast Guard District; the Reverend Hoffmann; and Major Richard L. Bland, USMC, Inspector-Instructor, Eleventh Infantry Battalion, USMCR.

The Association was particularly pleased to have in attendance at this meeting Mr. K. G. Irving of the Irving Machine Company, Tyler, Texas.

Mr. Irving is the donor to the Association each year of hundreds of beautiful Texas roses for the table decorations at the annual banquet. Mr. Irving was a representative of the Dallas Chapter.

Among the Chemical Corps members of the Association attending the meeting in addition to General Creasy, were Brig. General Marshall Stubbs, Chemical Corps Materiel Command, Baltimore, Md.; Brig. Gen. John R. Burns, Commanding General, and Dr. Carl B. Marquand of the Army Chemical Center, Md.; Col. John J. Hayes, Commander, Camp Detrick, Md.; Col. Robert W. Breaks, Commander, Pine Bluff Arsenal, Ark.; Col. George W. Dorn, Chemical Corps School, Ft. McClellan, Ala.; Col. William E. R. Sullivan, Executive, Office of the Chief Chemical Officer, Washington, D. C.; and Col. Donald D. Bodé, Commander, Dugway Proving Ground, Dugway, Utah.

Ladies Program

A separate program for the ladies was provided on Friday, June 17. This consisted of a luncheon and style show at the Higbee Company, Cleveland department store, a bus tour to the Cleveland Museum of Art, and an afternoon tea.

HARSHAW

Synthetic

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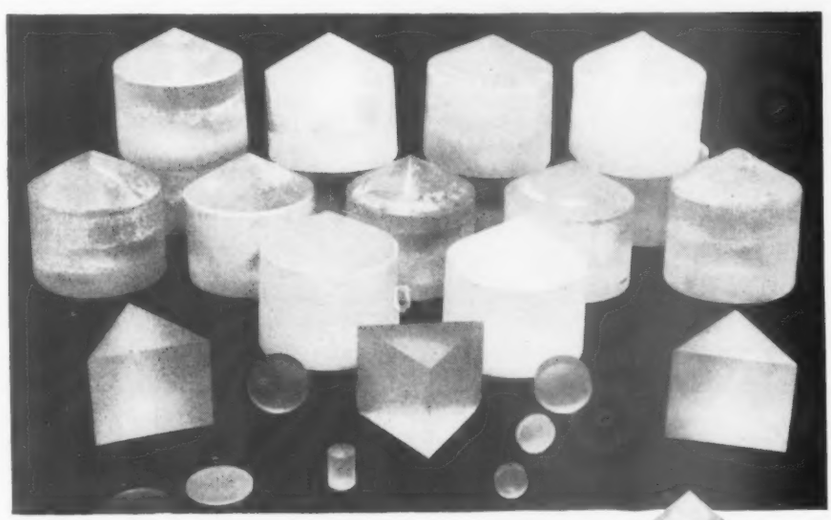

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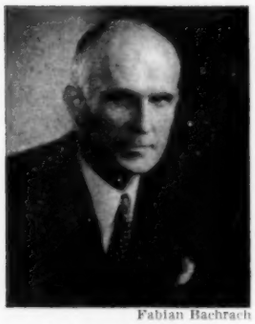

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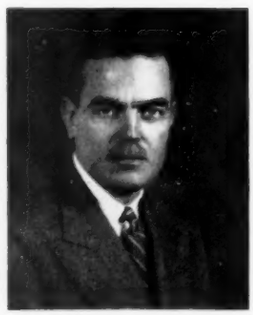

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SMOKE TROOPS GET EMERGENCY TRAINING FIGHTING JACK FROST IN UTAH ORCHARDS

DUGWAY PROVING GROUND—Recently the men and equipment of Dugway Proving Ground, Chemical Corps installation at Dugway, Utah, were utilized in an emergency operation to aid the civilian populace in the surrounding area.

On May 15-16, farmers in the Utah County section of northern Utah were faced with the loss of an estimated one million dollar fruit crop due to sudden freezing temperatures which swept across that portion of the state. The same farmers had lost approximately 20 to 30% of their crop in 1954 with a similar late freeze. The area is noted for its peaches, apricots, cherries, and apples.

Feeling that smoke would help protect the orchards from the freezing temperatures, a plea for help was sent out by Governor J. Bracken Lee, of Utah, to Lt. General Willard G. Wyman, Commanding General of the Sixth Army. General Wyman then contacted Colonel Donald D. Bode', commanding officer of Dugway Proving Ground.

Colonel Bode' immediately alerted military personnel present on the post, and within three hours a convoy of 69 vehicles, including five buses, was crossing the Wasatch Mountains enroute to the threatened area in the Provo valley.

Eighty-three M3A1 smoke generators, the vital equipment of "Operation Smoke Stack," as it was nick-named by some of the participating personnel, were mounted, and adequate fuel supply for a night's operation was taken along. Only a few weeks before 60 of these generators had been used in the atomic tests in Nevada.

Colonel Bode' had under his command for the operation 25 officers and 156 enlisted men. These men were from the Second Chemical Weapons Battalion, commanded by Major Frederick W. Jones, and the 9771st Technical Service Unit, commanded by Major Walter G. Atkinson, Jr., Troop Commander, Dugway Proving Ground.

Upon arrival at Provo, Colonel Bode' also had at his disposal 25 M3A1 smoke generators, which had been sent from Utah General Depot by Brigadier General Herbert A. Hall. There was a total of 108 generators available for the operation, although only 67 were actually utilized.

Colonel Bode' had been in contact with Mr. Elmer Taylor, District Representative for the Utah Department of Agriculture, and Mr. Ariel M. Jorgenson, District Commissioner of the Utah Department of Agriculture, since the beginning of the operation and at Provo was met by a delegation of farmers led by Mr. Joel C. Barlow, Assistant County Agricultural representative, who aided the military in locating the generators. Thirty-six generator positions were established, nineteen north and seventeen south of Provo, Utah.

On Monday, May 16, smoke was made from 2:00 A. M. to 6:30 A. M., during the critical temperature hours. The men remained on the scene until late Monday afternoon. Then warmer weather eliminated the need for the operations to continue.

An early estimate of the results of the operation indicated that 100% of the apples and peaches were probably saved, and the plum, pear, and cherry crops were thinned from the freeze but still profitable. The overall value of the exercise cannot be determined for some time. The civilian officials of Provo, Utah, and the State Highway Department expedited the movement of the convoy and aided the operation in general.

In summing up the operation Colonel Bode' said: "We were very glad to be of service to the civilian population in this area. Not only were we able to help them in their time of need, but it was an excellent training exercise for the men of Dugway Proving Ground. It gave them the opportunity to do some 'field soldiering' under emergency conditions."

COL. BODE

Colonel Donald D. Bodé, commander of Dugway Proving Ground, Utah, who carried out the smoke operation here described, is a native of Memphis, Tenn. Possessor of B.S., M.S., and Ph.D. degrees, he was Professor of Chemistry at the University of Tampa, Florida and also a consulting chemist before entering the Army in 1941 as a student officer. He served in the European, Africa, and Middle Eastern campaigns in World War II. Later assignments were with the Army of Occupation in Germany and the Eighth U. S. Army in Korea. He has been awarded the Legion of Merit and the Bronze Star Medal.

Utah Valley farmers utilize smoke generators brought by Dugway Proving Ground soldiers to protect orchards from freezing temperatures.

Two soldiers from the 2nd Chemical Weapons Battalion, Dugway Proving Ground, run a pre-operation test on an M3A1 smoke generator before departing for Provo, Utah, to protect the fruit crop.

USAF Northrop Scorpion F-89D unleashes air-to-air rocket barrage.

Chemical Progress builds a backbone for jets

In 1937, a chemistry student digging for a definition of *titanium* would have read this:

> Ti—Element No. 22, Atomic Weight 48.90, Valence IV. A widely distributed, dark-gray metallic element found in small quantities in many minerals. Discovered 1789. Classed as rare element 1900. Laboratory curiosity. *It has no important uses.*

By 1949, though, the chemical industry was spending $10,000,000 each year on titanium research. America's jet aircraft needed, for engines and structural parts, a lightweight, super-strength metal, resistant to the jet-speed heat that withered conventional aircraft materials. Only titanium met these requirements. Today, it's an important weapon in our defense arsenal and a valuable industrial metal.

Research also showed titanium's reliance upon chemicals. Five pounds of chlorine, for instance, are needed to turn out one pound of titanium metal. DIAMOND ALKALI produces chlorine and many other chemicals that work, often behind the scenes, to help make new products practical.

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WHAT THE CHEMICAL CORPS IS DOING*

By Major General William M. Creasy

Chief Chemical Officer, U. S. Army

The program for this afternoon's symposium lists me as speaking on "What the Chemical Corps is Doing." This is exactly what I propose to do, insofar as the bounds of national security will allow.

The strength of the Chemical Corps is not only the result of the work performed by the men and women within the Corps itself, but also stems from the support we receive from the AFCA and its membership. During the past year, I have visited with many of the AFCA's local chapters; I have talked with your members when they visited Washington, or when we met elsewhere. Individually, and collectively, you have all expressed the same thought—how can we help the Corps make progress. Thus, I feel that the topic assigned to me is most appropriate for this afternoon's gathering.

The Corps' progress can be broken down into three different major areas: management, research, and products. The facts about the progress we are making in these three fields should be of interest to you as stockholders and working partners in the national defense program.

Despite the fact that the Chemical Corps remains small personnel-wise, it remains in the big-business category. In Fiscal Year 1954, our business amounted to more than 200 million dollars in terms of goods produced and services rendered. For the fiscal year that ends on June 30th, we estimate that we will have done a business of 160 million dollars. These figures indicate a new sustained level for the Corps. We have had much higher and much lower business figures in the past, but they have reflected a fluctuation in the international situation. In war years, like almost everyone else, our annual business has been high. In peace-time years the figures have always fallen off, always below those I gave you for the past two years.

I cannot foretell what the future holds for the Corps, other than to say that there is a growing realization within the national military establishment of the importance of the Corps. The keynote for this thinking was embodied in President Eisenhower's last State of the Union Message when he said: "We must stay alert to the fact that undue reliance on one weapon or preparation for only one kind of warfare simply invites an enemy to resort to another . . ."

We in the Chemical Corps fully realize that chemical and biological weapons could be used against us either alone or in conjunction with nuclear weapons by an aggressor nation. This realization is also bringing some deep thought within the Department of Defense as a whole; thought which can lead to the placing of greater demands for ideas and equipment upon the Corps. The Chemical Corps, to justify its existence in a military organization that has not been involved in a toxic war in 37 years, must be fully capable of meeting all the demands placed upon it. It must be fully capable of meeting all the challenges the changing international situation may throw its way.

The prime requisite for maintaining and building this capability is good management. I am not saying that the Corps' past management has been poor, for it has always maintained a ready and alert organization. But I must say that it has not always been as effective as it should have been. Today, the Corps' management program is undergoing a steady evolution leading, we believe, to more efficiency. This evolution is the result of much thought from higher echelons as well as within the Corps itself.

For instance, as of the first of July, three of our posts—Army Chemical Center, Camp Detrick, and Dugway Proving Grounds—will become Class III installations. This is a new Department of Army classification.

As you may know, the Army has, for many years, had two types of installations. The Class I posts are those where the training of troops is the primary job, under jurisdiction of Army Commanders. The Class II posts have been those where research and development, or manufacturing, have been the primary job. These have been installations under the jurisdiction of a technical service chief, but where the Continental Army Commander in whose area the post is located, has had certain responsibilities. The responsibilities have included the budgeting, funding, and provision of personnel and equipment for what might be called the "housekeeping" duties; things such as repair and maintenance of buildings and roads, or the provision of medical, subsistence and certain administrative personnel. All of the Corps installations in the past have been of the Class II type.

This divided responsibility, in the past, has proven to be a source of frequent conflict and inefficiency. The concept of providing a commander with complete control of all resources—manpower, materials and facilities—essential to the accomplishment of his mission will be fully implemented on 1 July of this year. As I have already stated, some of our installations will be redesignated as Class III installations. These Class III Chemical Corps installations are those which have both logistical and other type functions. They will be under the control of the Chemical Corps but the Army Commander will provide more support in areas such as medical and administration than at the Class II installations. All other Chemical Corps' installations are Class II which include those which are primarily logistical.

* Address at the 10th Annual Meeting of the Armed Forces Chemical Association, Cleveland, Ohio, June 17, 1955.

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This new setup which gives us full control of the operations and maintenance of our installations, comes at a time when the Corps is getting a thorough scrutiny and evaluation of its assigned mission, its organizational structure, and its ability to carry out that mission. I feel that the situation is most fortunate.

A year ago, shortly after I took over as Chief of the Chemical Corps, I announced that I wanted to appoint a committee to evaluate the Corps with an eye toward increased efficiency. It took me several months to get the type of men I wanted on that committee; men who had a little knowledge about the Corps, yet not so much that they "couldn't see the forest for the trees"; men who are recognized leaders in their respective fields of management; not "yes" men, but men who could look into a situation and tell us how and why we are wrong. We found these men in Mr. Otto Miller, a vice-president of the Standard Oil Company of California; Mr. Hans A. Klagsbrunn, the Washington Counsel for the Olin-Mathieson Chemical Corporation; Dr. James A. Shannon who is associate director of the National Institutes of Health; and Mr. George H. Watkins, vice-president of the University of Chicago.

UNDER the chairmanship of Mr. Miller, the Ad Hoc Advisory Committee on Chemical Corps Mission and Structure has been visiting our installations and agencies since March. I have purposely refrained from sitting in with them on these visits because I do not wish to influence them as they seek the answers to such questions as: is the Corps conducting work in too broad a field, or is it not broad enough? . . .is it necessary for the Corps to continue to have troops of its own; or should the number be increased or decreased? . . . should we expand our contractual relations with industry and science? . . . do our field commanders have all of the operational responsibility that should be delegated to them? . . . are we making the best possible use of the talents of our military and civilian personnel? . . . is our organization responsive to the requirements of financial management?

These are areas in which I suggested the committee might delve. However, they have been free to consider problem areas of their own choosing which have shown up as they made their study of our organization. I know that about August 1, when the committee submits its report, I am going to receive a set of sound recommendations on which much thought has been given. And I intend to follow out those recommendations insofar as possible, so long as they mean that we will have a stronger and more efficient operational organization for the Corps.

Those are internal areas of management improvement. No matter how much good they do, they will be of little effect toward the national defense effort, if we do nothnig to strengthen our bond with industry. In the past our relationships with industry have been good, but there has been no solid foundation upon which this relationship could be built other than a spirit of cooperation.

Today, thanks to the aid of the AFCA, a Chemical Corps Industry Advisory Council is being formed—a group which should do much to guide us in our relations with industry. The Council is being made up of executives of industrial and educational organizations; men who have experience and training that will be of benefit to the Corps. They are men who have studied and worked in such areas as: Organization and management; process engineering and manufacturing in the chemical, biological, radiological, and incendiary fields; purchasing and industrial mobilization planning; inspection, materiel handling and storage; material components utilization from the metals, plastics, oil, and rubber fields; instrumentation; meteorology; cost accounting; and legal aspects. All of these are areas having a direct bearing on the Corps' activities which are necessary for the accomplishment of our national mission.

Within the Corps we have an activity which helps to bridge the gap between the developmental phase and the production phase of a new item. This is the comparatively new Engineering Agency which is located at the Army Chemical Center. This agency takes the completed experimental item from our research laboratories and engineers it for mass production.

It is also through this agency that the Corps is pioneering a program of closer relationship between the statistician and the engineer. Although it is not always apparent, there is a definite relationship in the work done by the two groups of professionals. Recently, to further this relationship, the Engineering Agency sponsored a Statistical Symposium at the Chemical Center. More than 250 researchers, engineers, and the cream of the nation's statisticians, from all parts of the country gathered to discuss statistics and engineering as applied to design of military weapons and equipment.

WE IN THE CORPS are convinced there is a need for this form of statistical engineering, and will do what we can to promote it throughout the military establishment.

The proper utilization of personnel requires a certain amount of education about the work they are to do. And, ever since the Chemical Corps School was activated, a great many people have spent a great deal of time trying to determine exactly what subjects we should teach, and how much emphasis should be placed upon each subject. There seems to be as many different concepts as there have been people attempting to resolve the problem. The problem still exists. Nevertheless, I am convinced that an objective analysis by a disinterested party can come up with adequate data to enable us to take the proper corrective action. Therefore, we have secured the services of a civilian management specialist who is familiar with the military education and training field.

As the result of the study he is making we expect to be able to formulate a better series of classes at our School which will more adequately train our officers in the types of work they will be called upon to perform either in the Corps itself, or when assigned to the field armies.

Officers throughout the Corps are presently undertaking the first phase of the study in the form of a three-hour comprehensive examination. The purpose of this test is to determine what our officers have learned of certain aspects of the Corps' operations, either by schooling or by experience, and how much has been retained through this learning. The results of the tests will be matched against the individual officer's schooling, duty assignments, and rank. The results should give us a start toward determining what subjects should be taught at the School, the types of non-Chemical Corps military education our officers should receive, and possibly how we can better utilize the natural abilities of our officers in the matter of job assignments.

The last area of management I want to bring to your attention is our Industrial Mobilization Planning program.

Because most of the Corps' needs from industry are unique in that they have few civilian counterparts, we must work doubly hard to let industry know what our needs will be if there is ever another M-Day. Our procurement offices are working quietly and effectively with

industry throughout the nation to give us a sound future procurement base in time of emergency. Five years ago, prior to the outbreak of the Korean War, we had industrial mobilization plans with 465 plants. In 1954, however, in an attempt to refine planning and to concentrate on those items essential to any future war effort, the Defense Department established a so-called "Preferential Planning List." This list consists of those military items on which planning *must* be accomplished. In addition, the Department of Army established a supplementary list of items, upon which Production Allocation Planning with industry *can be* accomplished, but planning on this supplementary list is not mandatory.

Under these revised ground rules, planning with some of the original number of 465 firms I mentioned a little while ago, was allowed to lapse, since the items were not considered essential under the new criteria. As a result, the plans now being developed are considered to be much more realistic and represent a refinement of plans. There are now approximately 250 industrial firms on this so-called "Preferential Planning List" with which the Chemical Corps is planning for war-time production. The list of items is constantly changing, since new ones can be added and obsolete items deleted upon the recommendation of either the using service or the procuring service.

I MIGHT add at this point, that the Corps has given the procurement responsibility for some 1,000 chemicals which are required by the Department of Army as a whole. This assignment is a part of the Defense Department's plan of centralizing procurement responsibility for certain fields of items with a single agency of the Army, Navy, or Air Force. The plan was designed to reduce the inter-service competition to obtain certain items on the open market. This competition has often resulted in wasted funds and manpower.

So much for what we are doing to improve management. Now, let's take a quick look at some of the work we are doing in the research and development field.

Never, in the history of man, has there been such a concerted effort on military research and development; not only in the United States, but throughout the world. Here, in America, the money being spent annually for all types of scientific research is 20 times what it was prior to World War II—and 85% of this money is being used for military research.

The Chemical Corps' share of this military research total amounted to nearly 50 million dollars during the last fiscal year, and more than one-third of this money found its way into private business organizations through our contracts for research and development work carried on by civilian agencies. Currently, we have in effect, contracts with approximately 373 commercial firms and universities for work in the fields of research and development alone. These contracts run from as little as $5,000, utilizing in part-time only, the peculiar abilities of unique individuals, to the multi-million dollar contracts utilizing large industrial organizations.

One of our test programs received national publicity recently in connection with the atomic explosions in Nevada. We have been working for several years on the theory that a blanket of screening smoke over a target area could effectively reduce the thermal, or heat, effect of a nuclear blast. The importance of this work can be seen in the fact that an estimated 75% of the casualties at Hiroshima and Nagasaki were burn victims. The heat from the Hiroshima bomb burned people and caused fires, throughout a 16-square-mile area.

In March, we put our laboratory and other field findings to actual use in a Nevada operational test. The smoke screen for this test was established by standard military smoke generators modified to permit their operation within the test area under remote control. The results obtained were indeed gratifying.

This operational evaluation of a smoke screen has shown that the thermal radiation can be reduced. It is the region beyond blast damage for which the smoke screens have the greatest defensive application, and this work will continue within the Chemical Corps until we have all the information considered necessary to properly determine this new application of fog oil smoke screens.

That Nevada test also had a secondary result. It showed us that we could effectively operate a large number of smoke generators by remote control under battlefield conditions. We were able to set up an effective screen within 7½ minutes, using only 36 generators and with very-light pre-dawn wind conditions. Such tests as these and the resulting data give us more information on which to base our "educated guesses" as to what could happen under actual attack conditions.

ALSO in the field of civilian protection, we have reached the point in development of our Civil Defense protective mask where we are working with several industrial firms on the final production problems.

A year ago, the chemical industry was quite concerned about our disposal of a by-product from the Muscle Shoals plant. We had such large amounts of phosphorous oxychloride as a by-product, that our disposal of it through the regular open market would have upset the economy of this important segment of the chemical industry.

In working on this problem, we have two groups to thank. The chemical industry helped us immeasurably in working out a method of placing the phosphorous oxychloride in the commercial market through the regular manufacturers of this product. The second group would be the Corps' SPP's—the enlisted men who have college degrees in the scientific and professional fields, and are serving their two years of military duty with us.

We put 60 of the SPP's on the Muscle Shoals job, and they really took over. Both the Corps and the TVA, which operates the plant for us, had regular civilian professionals on the job as well. However, the SPP's worked into the scheme so well that they ran shifts, served as operating engineers, designed and re-designed equipment. The TVA is so impressed with their work, that it is hiring many of them to stay on the job as civilians as their military tours expire.

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Incidentally, the Corps has nearly one-third of the approximately 5,000 SPP's in the Army. When the SPP program was started several years ago, we had a number of adverse comments as to our method of utilizing these young men. However, a recent survey of the SPP program showed that the Corps now has the least misuse of their talents of any of the technical services. In fact, the adverse comments regarding the Corps were so small and slight that they were included with the "miscellaneous" section at the end of the report.

Throughout the Corps, these young scientists and engineers are doing a great job. Their youth and enthusiasm have injected a new spirit into our research and development program, and they are coming up with ideas and developments of their own that are helping us to make progress.

Today, much of our research thinking is in the plastics field. This has become a necessity, for we consider it essential that our future Army be fully capable of airborne movement to meet the complexities of atomic warfare. Thus, we must lighten the load wherever possible.

For instance, our portable flamethrower now weighs 70 pounds when strapped to the back of the operator and ready for operation. This is a terrific load for a man to carry in combat. Any reduction in weight of this piece of equipment will not only make things easier for the soldier-operator but will also meet the requirement for the lighter equipment needed by an airborne Army. The problem is not simple though, for the weight of the napalm-gelled gasoline fuel is nearly 30 pounds, in itself. Naturally, we are seeking a lighter fuel that is just as effective as the napalm-gasoline mixture. But in the meantime, we are looking into the use of plastics to replace the metal components of the flamethrower. The problem here though, is to find a means of getting enough strength into the plastic to withstand the extremely high internal pressure that is necessary to operate the flamethrower.

WE HAVE also recently developed a new plastic protective cape for individual protection against air spray attack of toxics. The new item replaces the World War II cape which was hard to put on in time to prevent contamination and which was not too efficient.

Also in the field of plastics, we are working on an impermeable suit which would allow the wearer to safely operate in heavily contaminated areas from 15 to 60 minutes. The suit will be expendable, and will replace the heavy and cumbersome butyl rubber suits that are now needed for such work. The plastic suit will cover a man from head to toe, except for the face which will be covered by a protective mask, and the hands which will be covered by gloves.

As you all know, much of the research work we do in the medical field also results in contributions to non-military medical science. The key man in this research is Dr. David B. Dill, who is the scientific director for our Medical Laboratories at the Chemical Center. Just a few days ago, his outstanding leadership and work was recognized when the American College of Cardiology awarded him an honorary fellowship—the highest honor the College can bestow on anyone and one of the only two ever made. Dr. Dill has been a member of the College since 1949. He was also recently reappointed as a visiting lecturer in physiology at Harvard College.

So much for the field of research.

Just as with any business, the end product is the criterion used to establish the value of that business. The Chemical Corps is no different. Yet, we are in the unique position that many of our end products must remain "under wraps" until such time as an aggressor nation attacks us with CBR weapons. Naturally, for obvious reasons, I cannot go into a discussion of the Corps' end products as deeply as you would like me to. However, I can make a brief mention of a few of the advancements we have made in the field of protection during the past year.

Just recently, Dr. George Wright of our Camp Detrick staff was presented with the Award for Exceptional Civilian Service, the Army's highest civilian honor. The presentation was made for Dr. Wright's work in developing an anti-anthrax vaccine, which may give us an everyday means of protection against a disease that is just as deadly as polio.

We have continued tests on the effectiveness of the diffusion board, which I told you about at last year's meeting. This gas-aerosol filter material which has the property of filtering out toxic agents and allowing fresh air to enter an otherwise airtight room, can be of vital importance to the safety of our homefront.

We have also used this diffusion board principle in developing a new infant protector, which replaces a World War II model that was not much more than a big plastic bag with a canister attachment. The new protector is a rectangular box consisting in part of the gas-aerosol filter material for protection, semi-clear plastic inserts for vision, and a rigid bottom to support the child occupant.

During the last few months we have also developed and procured a new type of radiation dosimeter which is much easier to read than the older models and film badges. Through a chemical solution color-change principle, the amount of radiation is instantly shown.

In the past few minutes I have given you a brief resume of how the Corps is making progress. Progress that is fulfilling some of the "Technical Requirements of the Armed Forces and Industry," which is the theme for this afternoon's symposium.

BUT I have not mentioned one vital factor, a factor that is just as important as the revitalization of our management program or the use of smoke to reduce the effectiveness of enemy A-bombs. This factor is the need for a public understanding of CBR warfare; an understanding of the great hazards such warfare can present, and an equal understanding of the comparatively simple measures that can be taken to reduce the effects of enemy use of toxic agents against us.

The value of the lives of our people on the homefront is just as high as is that of our men on the battle lines. For, from the efforts of the behind-the-lines workers come the many things that makes the fighting man operative and effective. The breakdown of the homefront's health, morale, and economy would mean a proportionate decrease in our fighting power.

Thus, we must have an informed and educated public. Informed of what is available to protect against CBR warfare; educated to the realities of CBR warfare and how to use the protective means that we have devised.

We are making progress in this area, but it is extremely slow.

It is to inform the great mass of people that the Armed Forces Chemical Association can do a great deal of good. The method to do this is simple. The means are at hand.

I ask that what you have heard me say here today or what you may hear at your local chapter meetings regarding the Chemical Corps, not be treated as private information, but as information that should be passed on to your family, your friends, and your business acquaintances.

They too, are stockholders in our undertaking; if they expect dividends on their tax-dollars, they must know how to put those dividends into effect should our nation be attacked by an enemy.

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THE USES OF TECHNICAL MANPOWER*

By GUS C. LEE

Director, Office of Manpower Utilization
Office of the Assistant Secretary of Defense
(Manpower and Personnel)

AT THE TIME of our entry into World War I, according to a story told by Ambassador Conant, a representative of the American Chemical Society called on the Secretary of War, Newton Baker, and offered the service of the chemists in the conflict. He was thanked and asked to come back the next day. On so doing, he was told that while the offer of the chemists was appreciated, it was unnecessary as the matter had been looked into and the War Department already had a chemist.

World War II, particularly the manufacture of the atomic bomb, changed the attitude illustrated in the story. I have not talked to any military men who did not recognize that science and technology are among the basic foundations of national strength. The bomb has not yet eliminated arguments about strategy and tactics. But underneath the surface most of us realize that the ultimate effects of the ultimate weapons will be as profound as the invention of gunpowder was on the tournaments of the middle ages and on feudal society. Science and technology produced the bomb and science and technology in their turn depend on our ability to develop the scientists and engineers and to organize and use them effectively.

With only 6 percent of the world's population, the United States publishes 27 percent of the world's newspapers, owns 31 percent of all radio and television sets, produces 40 percent of electric power, uses 58 percent of the world's telephones and drives 76 percent of its automobiles.

This remarkable accomplishment in the productivity of the economy of the United States has been accompanied by persistent growth in our resources of educated specialized manpower. Since 1900, the number of professional personnel has increased at twice the rate of the population; school teachers have increased 1½ times as fast as the population, professional health workers 2½ times as fast, the number of engineers 5 times, the number of scientists 10 times.

Among these professional groups the scientist and to some degree the engineer have captured the imagination of the public. With the manufacture of the bomb, the scientist, in the public's mind, came out of the ivory tower and out of the laboratory and participated in the development and application of the technology of the bomb. The public became aware that the atomic field represented new concepts and theories in physics and chemistry. It realized that the same fraternity of men who were responsible for the atomic theories were also the leaders in atomic applications. As a group the scientists—to the public—are miracle workers bringing in a new atomic industrial revolution.

THE PRESENT public attitude about science, it seems to me, was well illustrated in a cartoon which appeared a few years ago in the New Yorker magazine. In the cartoon a company executive has just come into a laboratory, where he stands, with his hands behind him, talking to two chemists who have a harassed look upon their faces. In the caption under the cartoon, the executive is saying, "I hate to put pressure on you men, but we're in a dog-eat-dog situation. We've got to come through with another wonder drug and damned fast."

Those of us who work on the government's manpower problems, naturally, therefore, hear most about the shortage of scientists and engineers. We are told that the Russians are out-doing us in development of scientists and engineers. Our attention is directed at their manpower policies: scientists and engineers are exempt from military service. It has always seemed curious that some of the representatives of the scientists and engineers in Washington appear to be holding the Russians up as an example. They forget, so it seems to me, two important considerations: first, that we are a democracy and second, that, insofar as scientific manpower supply is concerned, quality is more important than quantity.

Taking a quick look, then at the supply-demand situation in the more important specialized fields, we may state the demand for engineers at 30,000 a year. Prospective graduates, although close to this number, will probably not meet the demand in the years immediately ahead.

In the natural sciences and in medicine, nursing, dentistry, prospective college graduates are inadequate to meet the demand in the several years ahead. The demand is sharpest for physicists, chemists and mathematicians. Fortunately, the situation at the PhD level is more encouraging in the natural sciences than it has been for the past several years. We can assume that this is favorable on the qualitative side. The graduate schools conferred 11,000 Doctor's degrees in the natural sciences in the five years ending 1952, over twice as many as in the preceding five years. These young PhD's have now acquired the few years of experience necessary to bring them to the threshold of their productive years. From 1953 to 1957, 13,000 Doctor's degrees in the natural sciences are estimated.

In the natural sciences, however, working scientists

*Address before the 10th Annual Meeting of the Armed Forces Chemical Association at Cleveland, Ohio on June 17, 1955.

without PhD's outnumber the PhD's about 6 or 7 to 1 It is estimated that the colleges will produce about 137,000 graduates with B.S. degrees between 1953 and 1958 and that somewhat less than half of these will go into scientific work. This number of B.S. degrees would not support continuation of the growth trend in research and development experienced during the decade of the 40's.

In law, business, and commerce, ministry, the social sciences and the humanities, supply of professional manpower will be sufficient to meet the needs.

The most serious national problem of shortages in the professional fields, in my opinion, is in education. The demand for school teachers may be estimated at 150,000 a year and the supply is insufficient by at least 50,000 a year.

IN THE MANPOWER field we have been entirely too slow in realizing how closely our country's strength is tied not only to the exceptional contributions of our especially educated manpower but also to the every day skills and abilities of our workers. What appears to be a shortage of scientists is also a shortage of skilled workers and technicians needed to back up scientists. About 676,000 people reported to the census in 1950 that they were members of the engineering and natural sciences professions. About 225,000 technical personnel were reported as supporting this group. We define a technician as one who carries out a variety of specific tasks, all of which are functional parts of the work of the professional man. Supreme Court judges have Harvard Law School graduates to write their briefs; an engineer has draftsmen to help him; a university professor has a research assistant. It would be very difficult to operate research labs and impossible to operate manufacturing plants without the diversity of skills represented in the skilled labor force, especially the skills of technicians.

Draftsmen make up about 50 percent of these technicians. Testing technicians and surveyors are the next largest groups. About 100,000 technicians are working with doctors and dentists. For the most part these technicians have "less than college level" jobs, although many of them have some past high school education.

During the past 15 years the directories of industrial laboratories issued by the National Research Council show technicians increasing 150 percent while professional personnel increased 90 percent.

I am emphasizing the role of the technicians because of its importance to utilization. In this respect we can all learn from the doctors—the most professional of us all. Improved medical care of the population may be due more to the increased use of medical assistants rather than an increase in the number of doctors. The number of technicians in the health fields during the past 50 years has grown at about 5 times the increase in the number of doctors. The doctor's resources go further because he knows how to use the technician, who has taken over many of the tasks which the doctor used to perform for himself.

There are 80,000 medical and dental technicians. They are younger than most workers; nearly 60 percent of them are women; almost one out of four has had a college education; they have by far the lowest average earnings of all technical supporting personnel. You see how smart the doctors are—they get young women, college graduates, and pay them less.

It may well be that the shortage of engineers could be cured the same way.

In discussing better use of technicians, we should remember that 150,000 high school graduates each year do not enter college. In connection with expanded use of technicians these intelligent high school graduates who do not go to college are especially important.

Better use of educated women is another promising avenue for increase of our professional resources. Women make up a small percentage, perhaps about 5 percent, of doctors, lawyers, engineers, ministers, although the percentages are larger than 40 years ago. In education, social work, journalism, where women earn more Bachelor's degrees than men, few women go on to earn their Doctor's degree. Also, in these fields, as in others, women on the average will occupy jobs which offer less pay, responsibility, and opportunity for promotion.

WORLD WAR II demonstrated that more effective use can be made of women during an emergency. But the role of women in our society is still a divided one, homemaking is still their major occupation, although most college girls are planning a career, sometimes half-heartedly. If "road blocks" were removed, however, larger employment of women in the specialized fields would result.

Good utilization means use of a person in the field in which he has been trained.

Astonishingly, this test of utilization is not met in many professional fields.

For example, the estimated occupational distribution of living holders of a degree in chemistry shows 22 percent employed as chemists in 1953. Thirty-one percent were in other professions, most of them practicing medicine. Eleven percent were in business as executives or managers, and 9 percent in other administrative jobs, such as hospitals.

On the whole these categories represent good utilization of trained manpower.

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However, 9 percent of the chemistry majors were salesmen, clerks, farmers and 6 percent were out of the labor field, either retired or in military service.

On the average, about 10 percent of all college graduates in the professional fields are engaged in nonprofessional work. If it were not for the high proportion of medical graduates who work as doctors, the average would be considerably higher.

Naturally, in my work, I am aware that some are of the opinion that military service represents the largest deterrent to effective use of our important manpower resources.

Some advocate a change in national policy to provide exemption for graduates in the physical sciences or engineering instead of the present policy of deferral on a case by case basis on the criteria of importance of occupation and industry.

The argument for change in national policy is based on the incapability of the Services to use professional manpower in accordance with their skills and training.

Most of the young professional personnel in Service, in fact, feel that they are well utilized from the standpoint of the needs of the Services, but not from the standpoint of advancement in their careers. For example, a geology major may be used by the Air Force in photo interpretation; a mathematics major in meteorology. We are using the man's aptitudes and capacity but not advancing his professional career.

Professionally qualified personnel primarily enter the Services as 2nd lieutenants through the ROTC route. In addition, a considerable number of college graduates enter the Army through Selective Service.

TO A LARGE extent, ROTC graduates with degrees in the physical sciences and engineering serve their active duty as line officers or deck officers; in the Army about half of them go into the combat arms and half into the technical services. In the Navy the greatest demand is for sea duty and ROTC graduates, as well as Naval Academy graduates with their B.S in Electrical Engineering, are assigned to sea duty. In the Air Force about half of the ROTC graduates with degrees in engineering or the sciences will have pilot duty. We have special and detailed procedures for controlling the assignment of officers who have scientific potential, but this control does not extend to the group who might be described as "working engineers." Most of the college graduates who enter the Army through the draft are identified in the Army's specialized personnel program, assigned to research centers for use in accordance with their training. They are shipped overseas only when there is a job requirement which uses their skill. The minimum qualifications for this special program are for one or two years of work experience in addition to a college degree. The Army can use about 5,000 inductees in this program. Until recently, supply was greater than the Army's requirement but with lowered draft calls, the Army should be able to assign practically all its intake of specialized personnel to this program.

The job requirements of the Services do not correspond with the occupational distribution of skills in the civilian economy. About 15 percent of our jobs have no counterpart in the civilian economy. For the most part, these are the jobs in the combat category.

But in relation to the civilian economy the Services are not large users of professional manpower. On active duty we have about 4.8 percent of the national supply of engineers; about 3 percent of the doctors; 8.6 percent of the physicists; 3.6 percent of the chemists; and 2.4 percent of the geologists. The percentage of men with a Ready Reserve obligation is even smaller in these occupational groups, except doctors.

About three out of four of these professionally qualified personnel have an assignment which makes use of their college training—a utilization record which is somewhat out of line, with experience in the civilian economy, but not as much out of line as most of our critics suppose. In my opinion, neither this record nor the supply—demand situation which we have previously discussed justify a change in the present public policy of deferral of college graduates in the sciences and engineering on a case by case basis on the criteria of importance of occupation and industry.

Obviously, wise national policy demands a balancing of the manpower needs of the military side and the civilian economy. The Department of Defense National Reserve Plan presented to this session of Congress, but not yet passed, recognizes this. Our policies and procedures for screening our reserve forces under the National Reserve Plan provide that individuals who have critical civilian skills in excess of our actual mobilization requirements for these skills will be screened out of the Ready Reserve. On the basis of our screening policies, an estimated 25,000 engineers would be screened out of the Ready Reserve. An estimated 2,500 of the 4,000 chemists in the Ready Reserve would be screened out and placed in the Standby category. Under present planning, individuals in this category could be recalled to active duty only after Congress had passed legislation authorizing recall of the Standby Reserve, an immediate requirement exists for the individual's military skill, and Selective Service makes the judgment that his present job is not essential in the civilian, war-supporting economy.

I THINK this audience would also be interested in the manpower and personnel situation in the active forces. The Secretary of Defense, Mr. Wilson, and Mr. Burgess, my boss, Assistant Secretary for Manpower and Personnel, are dedicated to making the Services attractive as a career on a voluntary basis to a fair share of the country's young men. Like any employer, we are interested in men of character and competence. Nearly half of our officers in Service have less than 3 years' experience; about 70 percent of our enlisted force are serving their first term of service; only slightly more than 1 out of 10 of these first-term personnel are reenlisting. It is extremely difficult to maintain an experienced, quality force under present conditions where about 25 percent of the force turns over every year. In Army, which must rely in part on the two-year Selective Service term to meet its needs, nearly 50 percent of the force turns over each year. Over 20 percent of all enlisted jobs above the level of private are technical jobs. To fill these jobs we need experienced enlisted personnel who will stay with us for a second and third term of service. This problem of maintaining a quality military force is one of the country's most important manpower problems.

I do not intend to convey that the question of who should be in uniform and who should not be in uniform is not also an important question of public policy. I do believe, however, it is too important to be solved by the suggestion that any one occupational group contributes so much to the national effort that they should, as an occupational group, be given a blanket exemption.

It has been said that in our age "to love one's country is vulgar, to love God archaic, and to love mankind sentimental . . ." Love of country, God, and mankind are among the values of Western civilization. These values

(Continued on Page 33)

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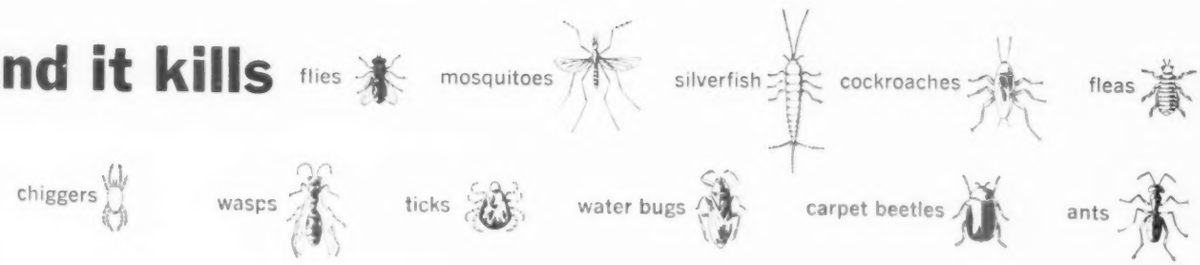

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OUTSTANDING ROTC STUDENTS

RECEIVING A. F. C. A. AWARDS

THIRTY-FOUR outstanding members of the ROTC representing thirty universities or colleges received awards this year from the Armed Forces Chemical Association. With a few exceptions all of the students selected were from those majoring in chemistry or chemical engineering. In one case the major subject of the student selected was mathematics but his minor was chemistry. In another the student's major was in biology. In all cases, however, the scholastic work of these students was concentrated on sciences applicable to the military program which are of special interest to the Association. Outstanding accomplishments in both military and scholastic subjects, as well as leadership qualities frequently reflected in extracurricular activities, formed the basis generally for these awards which were determined through cooperation with the Association of academic and military authorities. This is the seventh year since the practice of the Association in making these awards was established.

The award consists of a heavy bronze medal of customary military type suspended from a two-color ribbon of cobalt blue and gold, the Chemical Corps colors. The name of the recipient is engraved on the back of the medal. A regulation-type campaign bar for ordinary wear with the R.O.T.C. uniform is also provided. The awards made this year include 14 ROTC students enrolled in the Army program, 10 in the Navy, and 10 in the Air Force. Where practicable, presentations were made on behalf of the Association by a member of the chapter of the Association in the area in which the college or university concerned was located. Where this was not feasible the presentation was made by appropriate official of the institution.

Numerous letters from college military or academic authorities were received this year by the Association expressing interest and appreciation of the award program. The evident care exercised by all concerned in selecting recipients for the award testifies to the importance which is attached to this activity of the A.F.C.A.

Herewith are pictures of this year's award winners.

AVERY E. MCKINNEY
ROTC
A. & M. College of Texas
College Station, Texas

NOEL E. MOORE
ROTC
Purdue University
Lafayette, Indiana

STANLEY L. AMBERG
NROTC
Rensselaer Polytechnic Institute
Troy, N.Y.

WILLIAM S. CHILTON
NROTC
Duke University
Durham, N.C.

DOUGLAS M. STUART
NROTC
Purdue University
Lafayette, Ind.

JAMES A. WILSON
NROTC
Cornell University
Ithaca, N.Y.

MYRON W. BLACK, JR.
AEROTC
California Institute of Technology
Pasadena, Calif.

JOHN L. BURNETT
AEROTC
North Dakota Agricultural College
Fargo, N.D.

THOMAS O. DOBBINS
AEROTC
West Virginia University, Morgantown, W.Va.

MAR LYNN R. JAMES
AEROTC
Brigham Young University, Provo, Utah

DON E. CHILDRESS
ROTC
University of Illinois
Champaign, Ill.

WILLIAM G. DOTSON, JR.
ROTC
Wake Forest College
Wake Forest, N.C.

JOHN R. EAGLE
ROTC
University of Delaware
Newark, Del.

MCIVERS W. EDWARDS, JR.
ROTC
Massachusetts Institute
of Technology
Cambridge, Mass.

JOHN E. GREASEL
ROTC
Georgia Institute of
Technology
Atlanta, Ga.

LAWRENCE KRONENBERGER
ROTC
Carnegie Institute of
Technology
Pittsburgh, Pa.

PAUL F. MURRAY
ROTC
N.C. State College of
Agriculture and
Engineering
Raleigh, N.C.

JOHN W. OLSON
ROTC
University of Nebraska
Lincoln, Nebr.

STEVEN P. PAKES
ROTC
Ohio State University
Columbus, Ohio

CARROLL M. TOUPS
ROTC
Vanderbilt University
Nashville, Tenn.

WAYNE E. WOODMANSEE
ROTC
University of Oklahoma
Norman, Okla.

GERALD P. ZIEMBA
ROTC
University of Detroit
Detroit, Mich.

RONALD DARBY
NROTC
Rice Institute
Houston, Texas

JOHN B. HUNT
NROTC
Tulane University
New Orleans, La.

RICHARD E. KAMEROS
NROTC
Columbia University
New York, N.Y.

PHILIP M. PALMER
NROTC
University of Wisconsin
Madison, Wisc.

RICHARD C. RUSSELL
NROTC
Georgia Institute of
Technology
Atlanta, Ga.

ROBERT W. SCHAEFER
NROTC
University of Illinois
Urbana, Ill.

CARL T. LEVANDER
AEROTC
University of Texas
Austin, Texas

JAMES C. MELVILLE
AEROTC
State College of Wash-
ington, Pullman, Wash.

KENNETH J. RICHARDS
AEROTC
University of Utah
Salt Lake City, Utah

ROBERT L. USHER
AEROTC
Indiana University
Bloomington, Ind.

WELDON W. WALKER
AEROTC
A. & M. College of Texas
College Station, Texas

JAMES K. WILLIAMS
AEROTC
Georgia Institute of
Technology
Atlanta, Ga.

—U. S. Army Photo

Developer of Anthrax Vaccine Presented Army Civilian Award

Dr. George C. Wright, a Chemical Corps supervisory bacteriologist at Camp Detrick, Frederick, Maryland, recently was presented the Exceptional Civilian Service Award by Army Chief Chemical Officer Major General William M. Creasy, in a ceremony at the Pentagon.

The award, highest the Department of the Army confers on civilian employees, was given to Dr. Wright for his timely development of the first non-living anthrax vaccine acceptable for test in human beings. The original vaccine developed by Louis Pasteur in 1881 for cattle and sheep is essentially the same vaccine used at the present time. This and others like it cannot be used in man and are of limited usefulness even in the immunization of cattle.

Beginning work on this project in February 1948, Dr. Wright worked for more than four years, often on his own time, before a vaccine was developed which effectively protected experimental animals against anthrax.

Three months later, Dr. Wright recognized the importance of soluble enzymes produced by the anthrax organisms as being destructive of the anthrax antigen. He then utilized various genetic techniques to isolate an organism which has been used as the source of anthrax vaccine since.

Within eighteen months, Dr. Wright had developed a completely defined medium in which the anthrax antigen could be produced. With this medium, a more consistent and uniform standard production of anthrax antigen is achieved. In addition, the elimination of a foreign protein reduced the likelihood of adverse reactions when the antigen is used in man.

Dr. Wright achieved final success when he utilized an alum precipitation of the antigen with the result that a stable preparation was available for practical use.

This preparation has been evaluated and shown to be effective in a variety of experimental animals. In tests involving several hundred persons, it has been found to produce no toxic effects. The effectiveness of this vaccine is now being further evaluated by cooperative project between U. S. Government and Pennsylvania health departments by immunization of industrial workers in plants where anthrax is a hazard.

Dr. Wright, who was born August 17, 1916, in Ann Arbor, Michigan, is currently employed in the Immunology Branch, Medical Investigation Division, Camp Detrick, Frederick, Maryland.

He was educated at Redford High School, Detroit, Michigan; Olivet College, Olivet, Michigan; California Institute of Technology, Pasadena, California, and the University of Chicago, from which he holds the degree of Doctor of Philosophy.

★ COMMUNITY SUPPORTS ARMED FORCES DAY ★

EDGEWOOD, MD.—The Army Chemical Center, faced with the problem of having an "open house" on Armed Forces Day and not compromising essential security of its classified research projects, found a solution in an off-the-post community celebration that attracted more spectators than ever before.

Brigadier General John R. Burns, commanding general of the Center, appointed a committee to study the problem. The committee came up with a recommendation to offer the civilian authorities full Chemical Center support of an Armed Forces Day celebration at the town of Bel Air, the Harford County seat near the Center.

The civilians enthusiastically adopted the plan under the leadership of the Bel Air Chamber of Commerce. The Chamber raised more than $1,000 in subscriptions from Bel Air merchants to buy prizes for civilian parade units and to supply each youngster in town with an Armed Forces Day balloon. *(Continued on Page 43)*

Major General Milton A. Reckord, Maryland State Adjutant General and a native son of Bel Air, Md., and Congressman James P. S. Devereux, hero of Wake Island during World War II, join with Major John N. Wilkinson of Bel Air (right) to start the community celebration of Armed Forces Day.

U S. Army Photo

Mr. John N. Kunkel, president of the Bel Air, Maryland, Chamber of Commerce, which sponsored Armed Forces Day, and Brigadier General John R. Burns, commanding general of the Army Chemical Center at nearby Edgewood, lead the parade through the main streets of the Harford County community.

—U.S. Army Photo

The Marines were represented in a float illustrating the flag raising at Iwo Jima provided by the Bel Air Chamber of Commerce which sponsored an Armed Forces Day celebration at Harford County, Md.

—U.S. Army Photo

PRODUCING MORE TECHNICAL MANPOWER

By CLIFFORD F. RASSWEILER

Vice Chairman of the Board, Johns-Manville Corporation

An Address Before the Armed Forces Chemical Association 10th Annual Meeting June 17, 1955, Cleveland, Ohio

Dr. Clifford F. Rassweiler

Dr. Clifford F. Rassweiler, Vice-Chairman of the Board and Vice-President of the Johns-Manville Corporation, has been with that concern since 1941 and for the previous seventeen years was with the research organization of du Pont. He is widely known, not only for his scientific work, particularly with respect to new products in the paint and construction industries, but as an administrator. Dr. Rassweiler holds that the analytical approach of the scientist in developing new industrial products is applicable also in dealing with the more intangible human-relationship problems encountered in business organization and management, production and sales.

Dr. Rassweiler was born May 18, 1899 at Polo, Illinois, the son of a Methodist minister. He worked his way through college and holds an A.B. degree in chemistry and Honorary Degree of Doctor from the University of Denver and M.A. and Ph.D. degrees from the University of Illinois. He now heads his company's building materials research center at Bound Brook, N. J., which is said to be the largest such establishment in the world. Dr. Rassweiler is a member of the Board of Directors of the American Chemical Society, Past President of the Industrial Research Institute, Chairman of the Division of Engineering and Industrial Research of the National Research Council. He is Honorary Chairman of the Society of Chemical Industry's American Section; a fellow of the American Institute of Chemists and of the New York Academy of Sciences, and a member of the American Institute of Chemical Engineers.

SO MUCH HAS BEEN written and said about the shortage of scientific and engineering manpower that it seems superfluous to start this talk by presenting any figures to substantiate the conclusion that there is serious need for active measures to increase the production of such technical personnel.

So far as industrial needs are concerned, almost everyone here must be personally conscious of the impossibility of hiring enough technical manpower this year to provide for the needed research and engineering activities which are essential for maximum industrial progress. As regards our situation vs. Russia, the most commonly quoted and accepted figures are that our annual need for new engineers lies between 30,000 and 40,000. Against this need we produced 50,000 in 1950 without any evidence of surplus, but our production since has dropped annually until this year we will graduate only approximately 22,000 engineers. In the meantime, Russia has reached this year an annual production of 40,000 engineers by intensive development of scientific and engineering schools and concentration on the teaching of mathematics and science in the secondary schools. There is every evidence that a large percentage of these men are well trained.

However, there are no really adequate figures regarding the total number of available scientists and engineers in comparison with industry and teaching demands, and attempting to forecast in this area is difficult. As late as '49, a Government publication on occupational opportunities predicted an over-supply of engineers and rated attractiveness of engineering careers at a rather low level. There is a very considerable tendency to think of our present shortage of technical manpower as a short-time problem involving the discouraging Government forecast, the low birth rate of the '30's, excessively high industrial demand due to boom conditions, and the drain of military need upon available supply.

On the other hand, there is considerable justification for the belief that our present critical situation is at least partly due to long-range educational and economic trends, which are not likely to be reversed in the foreseeable future. The shortage of technical manpower has now been with us for almost 15 years. We blamed it first on draft policies during the First World War and the failure to continue training technical people during the war years. Yet the great upsurge in college enrollment which followed the end of the War did not fill up the deficiency in technical manpower which had grown so sharply during the War. Now we are tending to blame the continuing shortage on low college enrollments due to the low birth rates of the 1930's. All of the factors referred to in these explanations of course have an important effect upon our situation; but behind them lie certain long-range changes in our educational and economic situation which may be more basic causes for our difficulty. It is about the effect of these situations on our technical manpower supply that I would like to talk today.

Dael Wolfle, Director of the Commission on Human Resources and Advanced Training, in his book on "America's Resources of Specialized Talent" gives some interesting figures on the percentage of 4-year college graduates who have specialized in different fields in terms of averages for 5-year periods since 1900. These figures show that, during a period in which science and engineering have come to be of increasing importance in our industrial economy and our national defense, there has not been a corresponding increase in the interest of college students in these subjects.

Specialization of college students in chemistry, physical science, and mathematics, which provide the background training for our industrial research progress, reached its maximum in the 1911-1915 period when 9.9% of the 4-year degrees awarded in the United States were in these specialties. Since that time the interest of college students in these subjects has decreased in an almost even trend, until in the 1951-1953 period only 4.4% of the degrees granted were in these specialized fields. During this period expenditures for physical research in

this Country grew from less than 100 million dollars per year to approximately 4 billion dollars per year. Yet during the period of this phenomenal growth in this activity, interest of college students in preparing for this type of work, or for teaching to prepare others for this type of work, has dropped 50%. The reports of the Office of Education, now a part of the United States Department of Health, Education and Welfare, on "Earned Degrees Conferred by Higher Educational Institutions" give us detailed figures on an annual basis since 1949. These figures show that during this period the percentage of degrees awarded in the physical sciences has continued its slow decrease.

IT IS INTERESTING that during this same period, from 1911 to the present, the percentage of 4-year degrees awarded for specialization in the fields of social science and psychology has increased from 7% to 13.2%. In other words, during a period in which we have been disturbed by the thought that preoccupation with physical science was draining off the best of our college brains, what has actually happened is that interest in physical sciences has been cut in half whereas interest on the part of college students in social sciences has doubled.

The figures on engineering do not show as clean-cut a trend as the figures on physical sciences. In the period of 1916-1925, covering the First World War and Post-War adjustments, the percentage of 4-year degrees awarded for specialization in engineering averaged 9.7%. In the corresponding period from 1941-1950, the percentage was 10.1%. In the intervening years, the percentage of degrees which were awarded to engineers lay between 7% and 8%. It would appear, therefore, that the interest of our college population in engineering subjects has shown practically no increase during a period in which our industries have been converted largely to mechanized production, and during which we have seen spectacular increases in the importance of the electrical, the automotive, and the aviation industries based largely on engineering effort. The more recent trend, however, is shown most clearly by some figures in Dael Wolfle's book showing the percentage of 4-year-degrees granted to male graduates since 1947 which have been for specialization in engineering subjects. His figures show that from 1947-1953 the percentage has dropped in every year, making a relatively smooth trend line from 18% in 1947 to 12% in 1953. The bulge of 1950 in engineering degrees awarded was the result of high total graduation, not of increased interest in engineering. The detailed report of the Office of Education gives the further interesting information that this decrease in interest in engineering subjects has been sharpest in the fields of aeronautical, electrical, and mechanical engineering, where one might have expected the interest to have been greatest. In each of these 3 fields, the percentage of degrees awarded has dropped more than 50% since 1949.

It is obvious that we have been saved from what might almost be a catastrophe by the fact that the decreasing percentage of interest in physical sciences and engineering on the part of our college population has been compensated by the great rise in over-all college attendance. We are now in a particularly critical situation, because a simultaneous decline has been occurring during the last 3 years both in interest in these subjects and in total over-all college enrollment. It is possible that all we have to do is to struggle through to the point where total college enrollments will expand again as a result of the high birth rates of the 1940's. But the extent to which interest in science and engineering has failed to keep pace with its growing importance in our industrial civilization is too serious to be passed over without careful study.

There is a growing realization that the root of our trouble lies in long-range changes which have taken place in high school education. Both decreasing interest in technical subjects and inadequate production of technical manpower start with situations now facing our young people when they first enter senior high school.

There will always be a certain percentage of students entering high school who know definitely that they are going to college and even that they are definitely going to become scientists or engineers. Men with such definite convictions, almost regardless of where they live, can secure high school training which will qualify them for college admission and eventually for college degrees in their chosen specialties.

HOWEVER, the young people with whom we are concerned are those who enter high school without any definite conclusion as to what profession they intend to eventually follow, and even without any definite fixed decision as to whether they do or do not intend to take a college education. Among these are many young men who could become scientists or engineers but who also might become salesmen, ministers, or skilled mechanics. Our difficulty stems partly from the fact that the unconscious pressures to which they are subjected by our present high school educational system tend to turn them away from science and engineering, even though these might be very satisfactory professions for them to enter.

When a young man enters high school, his obvious primary objective is to get a high school graduation certificate. If he is intelligent and aggressive, he has a secondary objective of wanting to make a good scholastic average while doing so. If he definitely wants to go on to college, it becomes vitally important that this scholastic average be in the upper quarter or upper 10% of the class if he is to get into the college of his choice. Also, he has the natural objective of wanting to take part in at least a reasonable amount of extra-curricular activities; and the more intelligent he and his parents are about his eventual development, the more likely he is to feel impelled toward establishing some such suitable balance.

Also, being a natural human being, he sees no reason why he should work any harder than necessary to achieve these objectives.

In order to achieve these generalized objectives, a student quickly finds that it is wise to avoid science and mathematics as far as possible. This is particularly true for the earnest student striving to make high scholastic averages, unless he happens to be that rare creature who is a mathematical genius. Avoiding science and mathematics is an almost inevitable decision for the student who is trying to find the easy way to get a high school certificate or to get into a college of his preference.

If you have any question about this, ask your teen-age children or the children of some of your friends what are the "snap," or more colloquially called "gut," courses in their high schools or colleges. You will not find algebra, geometry, calculus, chemistry and physics included. In the old days, where the curriculum demanded courses which taught exact and disciplined thinking, the students were forced to take a considerable amount of this type of work. Now, however, with the liberal choice of studies and relaxed college requirements, the easiest way to get through high school and into college is to avoid as many of these subjects as possible. As a result, an increasing number of students entering college do not have the high school training necessary to qualify them for major work in science or engineering. In fact, college advisers say that it is very common to ask a student whether he would be interested in majoring in chemistry or physics, and

find that he has no conception as to what the adviser is talking about.

This avoidance of disciplinary subjects in our high schools is not simply a matter of laziness. Actually our present high school practices strongly tempt our most ambitious and intellectual students to avoid such subjects. We place a great deal of importance upon grades. Our more selective colleges are only interested in the high school students who have graduated with the highest scholastic averages. There is a very great temptation for the scholastically ambitious student to avoid those courses which he knows are most difficult in order to boost his scholastic average. I know it is true that the standard practice in each course is to adjust the grades so as to give the same distribution between A's and B's in calculus as are given in art appreciation, but any student knows that the mental caliber of the students in the calculus class represents tougher competition than the average mental caliber of the students in the art appreciation course.

To point up the seriousness of this situation let me give you a few specific examples.

Through my sons, I have followed the development of a young man of excellent mental ability who is now a student at one of the Ivy League colleges. In prep school he had his heart set on going to one of the Ivy League colleges, but to do so he had to have the financial assistance of a scholarship. I know that throughout his prep school course he carefully selected, as far as possible, only those subjects in which he thought he had the best chance of getting the highest possible grades. He got the scholarship, but he studied only the absolute minimum of math and science in his preparatory work.

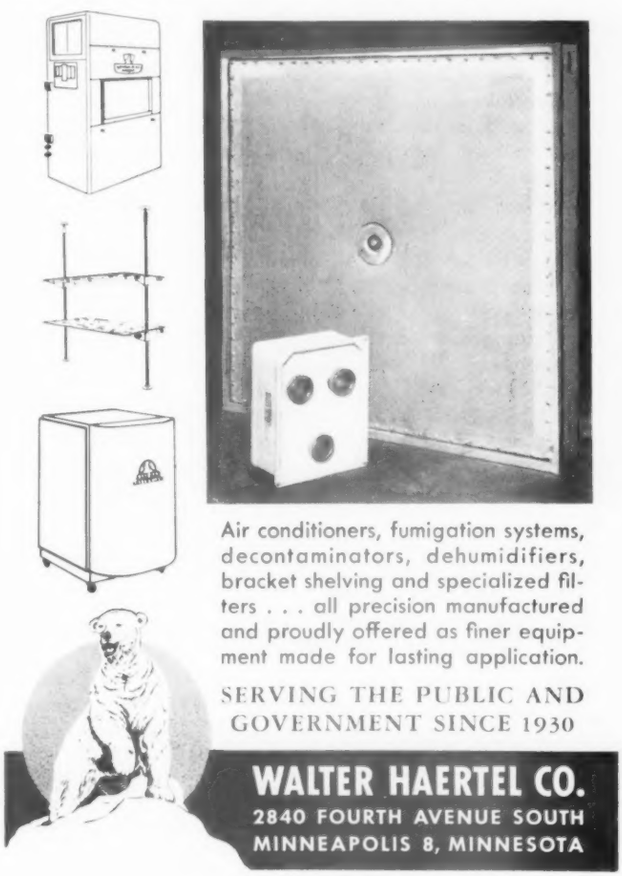
Another case is that of the son of an engineer friend of mine. The boy had gone through high school intending to be an engineer. He was in friendly scholastic rivalry with 3 of his friends who were going to specialize in business administration. His particular high school offered 2 senior courses in mathematics; one a special intensive course for prospective engineers, and the other a much easier and more generalized course for prospective liberal arts students. He took the engineering course; his friends took the generalized course. There was no question about his being a better mathematician than his friends; but, due to the greater competition in the specialized course, he got a B wheras his friends got A's. They graduated cum laude as a result and he did not. All 4 of them are now studying business administration.

One of the best of our smaller strictly liberal arts colleges requires 2 years of a generalized science course for graduation. The course is divided into 2 sections: one is a specialized course for science majors, and the other a generalized course adjusted to represent the minimum of scientific knowledge which they feel a liberal arts graduate should have. A few years ago they had a near rebellion among the students in the generalized course. They threatened to go on a strike because the work was too difficult and too many of them were failing. All this in a school which accepts for entrance only students with top high school grades. I understand unofficially that now this school, before admitting students, goes beyond their generalized scholastic average to make sure that they have a record in math and science which will insure their ability to successfully carry at least a minimum college science course.

I was talking to the assistant head of the home economics department in one of the teachers colleges. She says they are having difficulty in getting girls who will specialize in home economics because the course includes a certain amount of chemistry. In addition, they are having difficulty in getting those who do select home economics through the chemistry course largely because they are almost all highly deficient in mathematics preparation.

It would be highly unfair, however, to our young men to imply that their decisions to avoid mathematics and science are based entirely upon what is easy or expedient. If you talk to students in high schools or colleges, you will always be impressed by the fact that their selection of courses is greatly affected by their opinion of the teachers giving the course. The kind of intelligent, ambitious people we need in science and engineering are very likely to choose a tough course if they feel the teacher is interesting or particularly good. There is justification, therefore, for believing that the greatest difficulty with our high school situation is the steady long-range deterioration in the caliber of the teaching of science and mathematics in the secondary schools due to the difficulty of getting and keeping adequately trained science and mathematics teachers. If our high schools were adequately staffed with teachers who had a sound training for science and the personality to make students see the fascination which science and mathematics can have for an educated mind, we would not have to worry about the fact that other pressures were tending to drive even our ambitious and intelligent students away from these courses.

The difficulty of keeping the high schools supplied with properly trained science and mathematics teachers is the inevitable result of a long-range economic trend which there seems little likelihood of reversing. A man who would meet the specifications of a really capable and inspiring high school teacher of science also exactly fits the urgent needs of our scientist-hungry industrial machine. There is a very wide differ-



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ential salary-wise between the industrial opportunity and the teaching job. There is no reasonable possibility of either reducing the financial attractiveness of the industrial job or of raising the financial inducement of the teaching job to match that of the industrial position. School boards are almost unanimous in feeling that they cannot possibly pay the science teachers more than they pay their other teachers with university degrees. With the growing problem of providing schools for the mounting student population, there seems no reasonable likelihood that school taxes can be raised to the point where *all* high school teachers can be paid salaries comparable to what industry is paying graduate scientists. The high schools cannot pay a qualified graduate scientist any more than they feel justified in paying a young woman seeking a 3-year or 4-year job before she gets married. Therefore there seems little practical likelihood of solving our high school science problem by a radical and over-all improvement of the caliber of the people teaching science in the high schools.

There will always be some splendid science teachers in our high schools and one must speak words of praise for the industrial companies and other organizations who are trying to make the lot of these high school teachers of science more attractive by summer jobs, plant visits, and a variety of other efforts. However, as long as the major economic incentive draws scientific men to industry instead of to the secondary schools, we can only expect a worsening of the present situation where more and more science and mathematics courses are being taught by people who have had no specialized training in these subjects.

There are, however, three things which it should be practical to do and which should go far toward solving the problem of creating in our high schools a situation where a proper number of qualified students become interested in and prepared for scientific and engineering careers. Fortunately, all three of these things can be done by industry without getting involved in local school board politics or raising school tax rates. They can also be done without involving unreasonable expenditures by industrial companies who might cooperate in carrying them out.

First, and most obvious, of course, is an intensified campaign to explain to high school students at the beginning of their high school course the attractive possibilities and the opportunity for personal satisfaction which may be found in science and engineering careers. If the young man starting high school can be persuaded that such a career is what he wants, he will not be diverted by the pressures and difficulties which stand in his way. The National Association of Manufacturers and the Engineering Manpower Commission of the Engineers Joint Council have been doing excellent work of this type, and their success is already being reflected in a gradually increasing enrollment in many of our engineering colleges. One must also say a good word for the science fairs being held in many cities through the cooperative effort of high school science teachers and local industries. There has been some fear that this type of activity might draw into science and engineering men who were not suited for this occupation, but the very difficulty of the courses would seem sufficient assurance that those who do not have suitable interests and qualifications will drop off to other pursuits.

THE SECOND THING which might be done is a much more ambitious project. If we cannot provide stimulating and interesting teaching of mathematics and science in the high schools by recruiting highly qualified teachers, then we should turn our attention to revising teaching aids and practices so that these subjects can be taught in an interesting, stimulating, and effective way by men or women who do not have specialized training in these subjects. This would involve a joint effort of the very effective National Science Teachers Association, the teachers preparatory schools, and publishers of textbooks and teaching aids, working in cooperation with industrial public relations people and other industrial and entertainment people acquainted with the techniques of visual presentation. Certainly it should be possible to devise a teaching procedure for science which would be more stimulating, more interesting, and more effective than having science taught from a traditional textbook by a man who has never studied science.

This joint effort should also direct attention toward some change in scholastic gradings, both for high school honors and for college admission, which will give proper relative weighting to grades secured in difficult and highly competitive courses as compared with those secured in the simpler and easier courses.

The third thing which might be done is to provide more direct incentives to increase interest in the study of mathematics and science in our high schools. In other words, we might take advantage of the good old-fashioned idea of selecting a very luscious looking carrot and then holding it close enough to the donkey's nose so it will have some effect upon his behavior.

In its simplest and cheapest form, this might involve offering special prizes and awards for high school students doing particularly good work in mathematical and scientific subjects. Westinghouse, for example, is already doing an outstanding job in this connection. But the likelihood of achieving an award in the Westinghouse plan seems pretty remote to many of the people that we want to attract into the high school science courses. It might be better to provide prizes limited to the individual high schools which would involve honorable mention at the graduation exercises for those who have done outstanding work in science and mathematics along with those students who have done outstanding work in terms of general scholastic averages.

A much more direct incentive, however, would be a relatively large number of 4-year undergraduate scholarships assigned to individual high schools to assist worthy students from low-income families to attend college, with the provision that they specialize in scientific or engineering fields. A proposal that industry shift some of its funds from direct support of general college activities to this more specialized approach would, of course, be greeted with no enthusiasm by college presidents. It would, however, be a way by which industry could be sure that its support of education was providing help where industry and the nation need it most. From the college's viewpoint, there should really be no objection to this procedure if the scholarships were accompanied by corresponding direct grants to privately endowed institutions which might be selected by the scholarship holder.

So far I have dealt primarily with the problem of seeing that a higher percentage of the young men sent from the high schools to the colleges go with an interest in and adequate training for scientific and engineering specialization. There is, however, of course a very considerable group of people who feel that the solution of the shortage of technically trained people is to increase over-all attendance in our colleges. It is commonly stated that 50% of our best minds fail of their greatest usefulness because they are never college trained.

No one can take issue with the desirability of giving maximum training to the best minds in the country. One can, however, have considerable skepticism as to whether simply making higher education more easily available on a non-selective basis will achieve this objective. In view of the trends of student preference, one can be even more skeptical as to whether an increase in mass higher education would have a particularly large effect on the specific problem of the shortage of scientific and engineering personnel.

Any approach to the problem of getting a higher percentage of our best brains into the universities must face two situations. First, you have to create conditions in the high schools which will stimulate young men and women, particularly from the low-income groups, with a desire for learning and education. To do this, you must solve broadly the problem of providing inspirational teaching, which seems so impossible of solution in the scientific and mathematical field. Second, one must face changing economic trends, which are removing much of the economic incentive which used to make young men in the lower income groups strive for a college education.

In the early 1920's, the most obvious way for a young man in a low-income industrial family to avoid hard physical labor and to escape from marginal living conditions to a satisfying living standard, was either to work his way through college or to go through a trying and low-paid apprenticeship to achieve some skilled craft rating. To a very considerable extent, this pressing incentive no longer exists. No man with enough intelligence to secure a college degree needs to go to college in order to avoid earning his living by physical labor or in order to achieve a satisfyang standard of living. Mechanization of industry and agriculture is largely limiting heavy physical labor to those men incapable of running machines. Ownership of a home in nice surroundings, a good automobile, paid vacations, enough money to travel, assured continuous employment, and an opportunity to educate one's children are all easily achievable without a college education.

It used to be said that, if a man did not train his brain, he had to earn his living with his muscles. He had to either think or labor. It may seem facetious, but still surprisingly true, that a highly satisfactory standard of living can now be achieved without either thinking or laboring. In our highly mechanized industrial plants, highly paid laboring men with no technical training normally perform highly repetitive operations which involve no great physical effort. It is the highly trained engineer who takes a briefcase full of blueprints home to work on over the week-end, and it is the scientist who spends his evening reading scientific literature, while the skilled workman living next door watches television or takes a trip to the seashore.

There is very considerable question as to whether it is possible to attract into our universities the highly intelligent young men from what we talk about as low-income groups simply by making a higher education cheaper and easier to obtain.

Let us now consider for a few minutes the problem of how to insure our bright young men continuing to degrees in science or engineering even after we have gotten them to the university with adequate preparation.

In the university, educational pressures very similar to those in the high schools tend to drive young men away from specialization in science and engineering. Again, scientific and engineering courses are the "tough ones." The engineers have to report early to get some of their work done before the liberal arts people arrive. Often they get less credit for a given course than do the liberal arts students because they must pack so much work into a 4-year period. The science majors are almost barred from athletics and campus activities because of the long hours they must spend in the laboratories. Perhaps even more important, we have the same difficulty in providing inspiring science teaching, especially for the very large freshman classes. Too many of our potential scientists are discouraged from scientific careers by the fact that their freshman courses are difficult and not inspiring. Even our modern freshman chemistry textbooks concentrate the first freshman semester on difficult abstract conceptions of atomic structure. In too many cases, we are impressing college freshmen with the difficulty of acquiring a scientific education before we open up to them its interesting and challenging possibilities.

But, here again, there are plenty of men who have the intelligence and the perseverance to acquire technical degrees if they are convinced that the reward is great enough to justify the effort. Now, however, we are dealing with men who are thinking of rewards in much more realistic terms than scholastic prizes and scholarships.

We must face the brutal fact that, even among those going through college, science and engineering have not been of very high economic attractiveness. The laboratory scientist and engineers in industrial production were traditionally poorly paid all the way through the '20's, and '30's, and on into the '40's. To be sure, the shortage of technical personnel during the past 10 years has rapidly raised the starting rate for technically trained people: but, to a very large extent, this rise in starting rate has been only partially effective in raising the salary standards of men already in industrial positions. Young men, particularly from low-income families, are likely to judge the economic attractiveness of a scientific profession by the living standard of the middle-aged plant control chemist in the factory where their fathers work rather than by starting salaries paid by research centers. In most cases, the difference between the living standard of the plant control chemist and the skilled mechanic is not sufficiently great to cause the young man to place a very high value upon a science degree. In considering the value of an engineering degree, he is most likely to explore what advantage the graduate engineers have in his father's plant in comparison with high school graduates. In most cases, he is likely to find graduate engineers and upgraded skilled mechanics working side by side in industrial engineering positions with the same job classification and the same salary.

If industry hopes to persuade a very high percentage of the best brains from our low-income industrial families

(Continued on Page 33)

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By MORRIS T. CARPENTER

Administrative Director of The Research Department
Standard Oil Company (Indiana)

(Following is the address prepared by Mr. Carpenter for delivery at the banquet of the Armed Forces Chemical Association at the Hotel Cleveland, Cleveland, O., on June 17, 1955, which concluded the 10th annual meeting of the Association. Sudden illness prevented Mr. Carpenter from attending. However, he was represented by Mr. R. F. Baldaste, Administrative Director of the Company's Whiting Laboratories, Whiting, Ind., who delivered the speech in Mr. Carpenter's behalf.)

MR. CARPENTER

Mr. Morris T. Carpenter, Administrative Director of the Research Department, Standard Oil Company (Indiana) is president of the Scientific Manpower Commission, which has its offices in Washington, D. C. He is Chairman of the Manpower Committee of the American Chemical Society; a consultant of the Atomic Energy Commission and Alternate Representative of the Industrial Research Institute. Born August 9, 1909 at Glen Ridge, N. J., Mr. Carpenter is a graduate in Industrial Chemistry from the University of Kentucky and the Advanced Management Course, Harvard University. He served the government, on loan from his company, from January 1, 1952, to January 1, 1953, as Assistant Director of the Refining Division, Petroleum Administration for Defense.

THE PRINCIPAL theme of the meeting here at Cleveland is "The Technical Requirements of the Armed Forces and Industry." Most of you here tonight understand the significance of this problem. However, the general public does not appreciate the importance of technology in modern warfare. They do not understand that the Armed Services need highly trained scientists and engineers to operate the present-day weapons of war. They do not understand how long it takes to develop and produce these weapons. Therefore, I think our principal problem is one of public education. This is a job in which all of us can take a part.

For example, why should Johnny Jones, down the street, shoulder a gun and stand in the front line trenches while Billy Smith accepts a job at some Atomic Energy Commission Lab and makes a salary several times that of Johnny Jones? This is the question that Mrs. Jones will ask.

The answer is simple; but Mrs. Jones does not know the realities of modern warfare.

The facts are, there will be no "front line trenches" in the next war. Atomic bombs will not be wasted on a few people in what used to be called "front lines." They will be reserved for the people who are producing the weapons of war.

This means that our concept of "equality of sacrifice" has to be changed. It used to mean that Johnny Jones, out in the front line trenches, was making more sacrifice than Billy Smith back at home. This is no longer true.

If we are to survive in the modern world we must understand a concept which we might call "equality of contribution."

You may well ask "Contribution to what?" The only answer is "Contribution to national survival."

It must be obvious to everybody here tonight that there is no possibility of outnumbering the Russians plus the people under their control. Our only hope of survival is, somehow, to be smarter than they are.

So far, we have not been very smart.

Let me document a few facts to show that we have not been very smart.

1—In 1954 Russia graduated about 54,000* engineers while we graduated about 20,000. Where will our technological superiority be a few years from now if this trend continues? And don't kid yourself the Russian engineers are well trained.

2—During the last couple of years the Selective Service system has operated on the basis that every physically qualified man should spend at least two years on active duty in the military services. In some instances this has meant that highly trained and experienced scientists and engineers have been assigned non-technical duties where their talents and training were entirely wasted. In view of the shortage of such individuals this has been contrary to the best interests of the national welfare. Fortunately there are present indications that this problem is becoming better understood by Congressmen and other governmental officials who have responsibility in this field. I don't know just what will be done but I feel encouraged that a more realistic approach to better utilization of scientists and engineers is in the offing.

3—How about the future? Does it look good? It takes a long time to train a scientist or an engineer. How are we doing about interesting our youngsters in these fields? Figures presented at a conference held at Harvard University in July and August, 1953, showed the following:

*This figure is understood to include both of the two Russian grades of Engineer graduates, one of which is lower than our B.S. degree rating.—Ed.)

a. As GI benefits have expired, the number of college graduates has dropped 31% between 1950 and 1953. Even ignoring science and engineering, is this very smart?

b. The percentage of college graduates qualified to teach science decreased by 48% between 1950 and 1953. If the next war is going to be won by science and engineering, this statistic does not look good for our side.

c. In 1953 the need for qualified science teachers exceeded 7,000 per year and the best estimates indicated the requirement would soon approach 10,000 per year. Analysis of the potential supply indicates a maximum of 5,000 graduates from college qualified to teach science. Of course, some of these 5,000 will not enter the teaching field. In the face of these figures our future does not look good if science and engineering is the basis of our survival.

OF COURSE, the $64 question is where do we go from here. So far, the things I have said probably sound rather dismal. I hope they do, because I think that something needs to be done about the current situation. Also, I think that everybody in this room can help. In spite of the dismal statistics I have just quoted, I want you to know that I am not a prophet of doom. I have complete confidence in our way of life. I am equally confident that essentially all people in this country will do everything they can to preserve our form of government and provide maximum liberty for everybody consistent with the maximum benefit for all.

The over-all problem is, of course, to figure out how we can best defend our country. As of now, I think there are two aspects to this problem, and we must recognize both. The first is a long-range project and the second needs immediate attention although the problem will probably be with us for a long time.

As I see it, the problems are these:

1—How can we make science and engineering of more interest to our youngsters than has been the case in the recent past? This is a long-range project.

2—What should be done about current legislation governing selective service and the reserves? This problem is before us now and some decisions will have to be reached soon.

With regard to the first problem, it seems to me that the over-all question is one of determining how we are going to handle the secondary school problem. If we can insure that secondary school education as a whole is good, it would seem to me that the science and engineering professions can probably get their fair share of students in their fields of interest. It has been suggested by some that teachers of science and mathematics might be subsidized, perhaps by industry, so that there would be special inducements to teach in these fields. It seems to me that this would be a mistake and ultimately would cause dissatisfaction and poor morale among other teachers who are not so subsidized. I think our best policy should be to insure so far as possible a sound secondary school system in all branches of education.

If our secondary school system is going to be maintained even at present levels of efficiency, we are going to have to do a great deal more than we are doing now. During the next two decades there will be a substantial increase in the number of students in high school and higher institutions of learning. Dr. James R. Killian, Jr., President of the Massachusetts Institute of Technology, has said, "between 1960 and 1970 the enrollments of our high schools and our post high school institutions and colleges will double. If we wish to provide as much college plant per student for the prospective 4,400,000 students in 1970 as we now provide per student for half that number, we will obviously have to build as much new college plant in the next 16 years as we have built in this country in the past 300 years."

In 1953-54 there was a reported shortage of high school teachers of 112,000 and the shortage increased in 1954-55 to 125,000. Analyses of university students completing training for high school science and mathematics teaching indicates that the shortage will become greater in the next few years. Estimates indicate that by 1960 we will need about 700,000 more high school and elementary school teachers than we have now. It should also be emphasized that the shortage is qualitative as well as quantitative, particularly in the fields of science and mathematics. Many of the present teachers are not qualified to teach these subjects. A very substantial number do not have the ability to present these subjects in such a fashion as to inspire students to seek careers in science and engineering. Word seems to have gotten around among the present generation of high school students that science and mathematics are extremely difficult subjects and should be avoided if at all possible. These subjects are difficult only if the teacher makes them so by presenting the subject matter in a routine and disinterested manner. Most of us here tonight know that science and engineering are fascinating subjects and a lifetime career in these field is one of great satisfaction.

Of course the principal difficulty in attracting teachers for high schools is money. Salaries paid high school teachers are notoriously low and the citizens of many communities strongly resist any attempt to improve the financial status of the teachers who have charge of their children. It is certainly a sorry state of affairs when the United States public spends substantially more money for liquor than they do on all forms of education combined. Current spending for elementary and high school education is something over eight billion dollars per year. Our annual crime cost is estimated by the Department of Justice as twenty billion dollars per year. It is certainly something to think about when we allow 2½ times as much for crime as for elementary and high school education. Also it is interesting to note that in 1954 the U. S. funneled American tax dollars to 54 foreign lands at a total of more than five billion dollars. I have no objection to foreign aid, but I think we must reappraise the amount of money we spend on the future of our country in terms of educating our children.

I SAID a few minutes ago that money is the principal source of difficulty in providing adequate education. This is undoubtedly true. The situation has become progressively worse over the years and unless something drastic is done about it, we are facing a very dim future. For example, in 1938 teachers were in the top third of the income groups of the country but only ten years later they were in the bottom third. This trend must be reversed or else we can hardly expect the children of the country to receive adequate education in the years just down the road.

Basically this is a problem of public education on a broad scale. It cannot be solved by organizations throughout the country who are working along these lines. The organizations can do a lot of good by placing in the hands of educators and the public facts and figures showing the current and probable future situation. How-

ever the real solution will come only when the people in all of our communities understand the problem and agree to do something about it. This is a job for each and every one of us. I would strongly urge that everyone in this room make it a point to talk with community leaders and urge that we start spending more money on the education of our children. One of the most useful things you could do would be to run for election on your school board. Many of you could bring important experience to the problems faced in running a school system. At the very least you could become acquainted with the members of your school boards and offer your assistance in whatever field you think you have specialized knowledge and experience.

Turning now to current legislation the picture is so confused that I hardly know what to say. The House of Representatives has passed HR 3005 and sent it to the Senate. This is merely a bill to enable Selective Service to continue drafting men for the armed forces after June 30, 1955 when the present authority runs out. It will make no change in our present policies and procedures unless it is amended some way in the Senate, which appears unlikely at the present time.

During the last couple of years the Department of Defense, the Office of Defense Mobilization and others in Washington have been working on a proposed bill to establish a sound and effective reserve force. Most of you know that the present rules and regulations covering the reserves are not strong enough to insure a really effective reserve which could be brought into action quickly in case of an emergency. The so-called "Administration Bill" to establish such a reserve was spelled out in HR 5297. Hearings were held by the House Armed Services Committee and a great many organizations presented testimony. I think you are familiar with the provisions of this bill and it is not necessary to spell out all of the details here tonight. The bill was brought to the floor of the House for debate and unfortunately certain amendments were tacked on to the bill which virtually prohibited its passage. For example there was an amendment effected by Representative Powell of New York barring segregation in the national guard and reserve units. In addition, Representative Bow of Rhode Island succeeded in having adopted an amendment which would have banned the use of American troops in nations which exercise criminal jurisdiction of such troops for violation of foreign laws, under existing treaties or executive agreements. It was quite apparent that the bill had no chance of passage in its present form and, therefore, Chairman Vinson of the Armed Services Committee was successful in having action on the bill suspended. It can be brought up again in the House, but unless somebody can come up with a suitable compromise, it is doubtful that it can be passed.*

In his press conference on June 8, President Eisenhower appealed to the Senate to revive and enact the Administration's military manpower reserve program. Its passage should not be blocked by an extraneous anti-segregation rider, he said. The President asserted that failure of Congress to authorize the reserve program could not be compensated by any feasible, logical increase in the size of the armed forces on active duty. According to Mr. W. H. Lawrence of the New York Times, the President thought sponsorship of the anti-segregation amendment was an attempt to force a particular view on social progress at the expense of a general program absolutely needed by the country as a whole. The President further stated he felt that the Reserve bill was vital and if the House situation had gotten so difficult that they could do nothing there now, he most urgently hoped that the Senate could do something about it. He presented a number of important arguments as to why the Reserve bill should be passed without delay.

It is, of course, impossible to say at the present time what the future of the Reserve bill will be. It is obvious that the bill has powerful support and it seems reasonable to expect that something will be done along these lines even if the matter has to be carried over to the next Congress. In addition, it is possible that at least some aspects of the program can be carried out by Executive Order. It would be helpful if each of you would write your Congressman expressing your views on this subject. It is a matter of vital concern to the defense of our country as well as of critical importance to the efficient operation of industry, education, and the government itself. I think it is quite significant that the Honorable Frank D. Newbury, Assistant Secretary of Defense for Applications Engineering, stated at a meeting of the American Society of Mechanical Engineers in Baltimore on April 19, 1955, "the most serious limitation on progress in our over-all defensive position, especially in the development field, is the scarcity of qualified research and engineering and production organizations, and the scarcity of qualified scientists and engineers to man them—not funds."

IN SUMMARY, I think that we are discussing a problem to which all of us can contribute. In connection with legislation now under consideration, each of you should write your Congressmen and, in particular, the members of the Senate and House Armed Services Committees, urging them to enact some kind of legislation which will insure that each individual will be permitted to do the job where he can do the most good for the welfare of the country. I am referring principally to scientists and engineers at the present time, but it should be clearly understood that other people with specialized training might become equally critical in the event of a national emergency. For example, tool and die makers or welders might become of critical importance to the national defense if war were declared and it suddenly became necessary to produce more ships, tanks, planes, and other weapons of war. The scientists and engineers represent a very small percentage of available manpower for the military services and they should be inducted only if the military has a specific need for the scientific or engineering training of each individual. Because of the current shortage of people with these kinds of training, it is essential that they be used to maximum advantage in terms of the national welfare. The results of their work frequently require several years before the final product is useful to the military forces or to industrial organizations who must supply the military. Therefore, it is imperative that we establish sound procedures for utilizing those highly trained people while there is still time.

With regard to the second problem, I would urge each of you to become active in your own communities in connection with the secondary school problem. Talk to the leaders in your community and be sure they know the facts regarding the tremendous problem we are facing during the next few years. Use all the facilities which you can command to disseminate this information as broadly as possible. I would urge you to run for election on the school board in your community. If you feel that you do not have the time for this activity, at least you can

*As the Journal was about to go to press announcement was made that Chairman Vinson had introduced a new reserve force bill which eliminates or modifies controversial features of HR5297.—Ed.)

become acquainted with your school board members and offer your services in connection with problems in fields where you feel your training and experience would be of value.

These are both long-range problems of public education. The welfare of our country is at stake and we can expect serious trouble unless satisfactory solutions to these problems are found soon. All of us have parts to play and I hope that we will accept this responsibility —and contribute our part to the survival of our country.

MR. LEE'S ADDRESS

(Continued from Page 20)

are not subject to experimental verifications. Whether or not one believes they are worth saving is more a matter of personal philosophy and faith. I believe that the chances of saving them would be considerably less if our especially educated, specialized manpower—the leaders of our society—did not participate in the personal sacrifices necessary to save them. I realize this is a conservation notion. But it seems to me to conserve one of the important ideas of our democratic tradition.

DR. RASSWEILER'S ADDRESS

(Continued from Page 29)

to strive for scientific or engineering degrees, they are going to have to put a larger and more obvious dollar value on the possession of such degrees on the part of the people who work in our industrial plants.

In most companies it is still true that the most likely route to high salaries and general management responsibility is through the sales department, rather than through the research or engineering departments. The rapid rise in the attractiveness of business administration courses to college students is probably at least partly due to the ease with which young men gain an understanding of this situation through their parents or their friends.

There is considerable reason for believing that industry supplied its needs for trained professional men during the early days of mechanization and industrial research from that class of people who went to college and took professional training because they came from family and income backgrounds which made this a more or less automatic educational choice. There is equal reason for believing that our 15-year-old shortage of scientists and engineers, which is now reaching its most acute stage, is due in considerable measure to the fact that industry's need for technical personnel can no longer be satisfied from this source. Now we must attract into these professions men who will only become scientists and engineers as their interest in these fields is aroused during high school days, and who can be carried through to technical degrees by incentives which make them feel justified in the special effort involved. Failing to do this, we may continue to see a higher and higher percentage of the mentalities we need in science and engineering turning instead to social sciences, business administration, and sales.

AN ADEQUATE supply of scientists and engineers is essential both for our own economic welfare and for our safety in the cold technical war with Russia.

We believe that our democratic system of free choice is better than Russia's dictatorship. However, in our civilization, it is often very difficult to achieve the balance of incentives which will cause a sufficient number of our people to do of their own free will the things which are essential for our our national well-being.

The Russian system may be less effective in the long run, but it certainly has the advantage of simplicity and prompt action.

The Russians have decided that this is a scientific and mechanical age. They therefore feel it is important that their educated people have a thorough understanding of science. They are accomplishing this by the simple expedient of requiring that a considerable portion of the study time in their elementary schools be spent on science and a thorough grounding in mathematics. They specify that in their schools which correspond to our high schools 40% of the students' time must be spent upon mathematical and scientific subjects. In Russia you cannot even achieve a high school education without a thorough grounding in the fundamentals of science.

The Russians have decided that this is a technological age in which industrial progress and national defense require a fully adequate number of trained scientists and engineers. They consider this so important that they are not content with their ability to assign students to engineering schools, and they are using the good old capitalistic technique of providing economic incentive. As a class, men with scientific and engineering degrees are the highest paid people in Russia.

We who pride ourselves upon our scientific and industrial leadership, need to take positive and effective steps to provide the kind of educational and economic situations which will produce an adequate number of scientists and engineers. It is equally important that we do something to counter the obvious trend in our educational system which tends in this age of science to produce an educated class which has less basic knowledge of science than the educated people of 20 years ago.

ARMY MATHEMATICS CENTER

Plans for establishing an Army Mathematics Center to carry on research and investigation of mathematical problems outside and capabilities of Army facilities were recently announced.

The organization will be set up by contract with an educational or research institution.

Subject matter considered includes numerical analysis, engineering physics of high speed computers, statistics and probability, applied mathematics, analysis, linear and non-linear programming.

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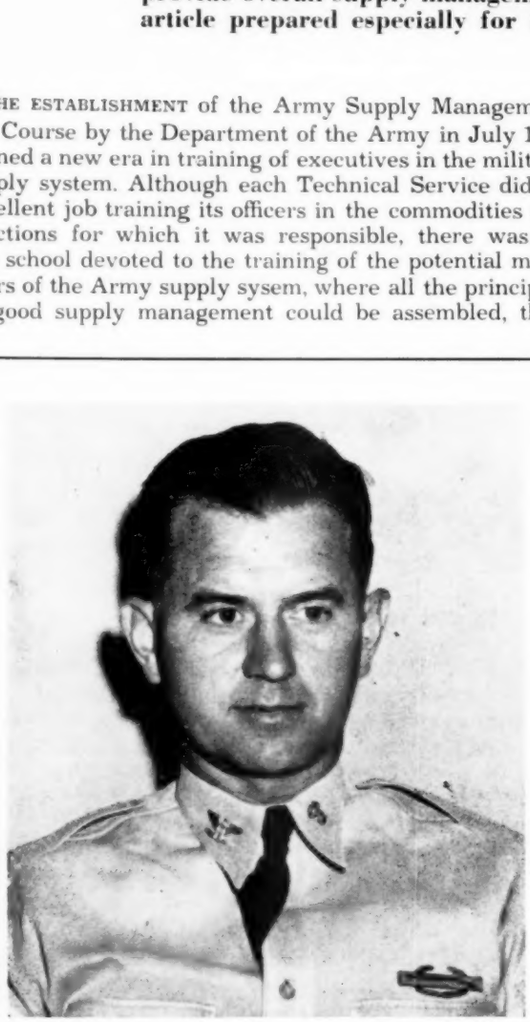
TRAINING THE FUTURE TOP MANAGEMENT OF THE ARMY SUPPLY SYSTEM

The Story of the Army Supply Management Course

By COLONEL THOMAS B. EVANS, *Director*

In an address in Chicago on October 14 last, sponsored by the Midwest Chapter of A.F.C.A. (see January-February 1955 JOURNAL), the Honorable John Slezak, then Under Secretary of the Army, declared that the magnitude and complexity of the modern Army supply system necessitate the development of highly qualified officers for permanent careers in logistics. The Army's new Supply Management Course, established at Ft. Lee, Va., to provide overall supply management training, is described in this interesting article prepared especially for the JOURNAL by the course director.—Ed.

THE ESTABLISHMENT of the Army Supply Management Course by the Department of the Army in July 1954 opened a new era in training of executives in the military supply system. Although each Technical Service did an excellent job training its officers in the commodities and functions for which it was responsible, there was no one school devoted to the training of the potential managers of the Army supply sysem, where all the principles of good supply management could be assembled, their inter-relationship examined and a philosophy of sound management developed and expounded. It is true that the Army was utilizing the facilities of the better graduate schools of business administration and on-the-job training in industry, but the number of personnel who could be afforded such training was limited. Further, this training normally did not consider problems peculiar to the military.



Colonel Thomas B. Evans, director of the Army's Supply Management Course, Ft. Lee, Va., was graduated from West Point in 1933. During World War II he served with the headquarters of the Armed Service Forces and after the war served on G-4 assignments in Europe and later as Post Quartermaster in Tokyo. Colonel Evans has a Master of Science degree in Business Administration from Leland Stanford University, is a graduate of the Industrial College of the Armed Forces, the Armed Forces Staff College, and also the Infantry School.

Let us examine for a moment how the need for this type of training developed. It is generally recognized that, from the time of the Revolutionary War up to and indeed into the period of World War I, warfare was essentially the physical conflict of one human being with another and logistical support of the participants was considered an incidental. It can, therefore, be readily understood why the major emphasis was laid on the training, discipline and employment of the individual combat soldier. Today, however, we find ourselves in a different situation. The latest concepts of land warfare are built around the maximum employment of complicated items of materiel and equipment, not only costly to procure and maintain, but requiring extensive logistical support. The importance of logistics in modern warfare has made imperative a quality of top management and coordination, which the Army had to recognize and prepare to meet.

This country now finds itself in the era of the "cold war." We may be faced with this situation for many years. The American people have indicated that, such being the case, they are willing to maintain a strong military establishment as insurance against another world conflict which could only be more devastating than ever before. There is a limit, however, to the amount that our economy can afford to pay for this insurance. Every dollar of the Army's budget, that can be diverted from unnecessary expenditures to the support of combat soldiers and provision of major items of equipment, will provide more and better insurance of the type that the country desires. In order to provide the most defense per taxpayer's dollar, the military supply system must be operated in the most efficient manner. The key personnel must be trained in the tools and techniques of sound business management.

One Million Items in Inventory

SOME CONCEPT of the Army's supply system may help also to give an appreciation of the problems facing the supply manager and show the necessity of having the

best qualified and trained individuals in the key managerial positions. At the present time the Army holds an inventory in its warehouses of $20.1 billion, consisting of nearly one million items. Of this inventory, $3.8 billion is located overseas. An additional estimated $5 billion is on order. For comparative purposes it might be noted that the inventories of goods and merchandise held by private industry are valued as follows: $43.6 billion in hands of manufacturers; $11.7 billion held by wholesalers; and $22.4 billion on the shelves of retailers. (Source: U.S. Department of Commerce as of 28 February 1955.) The 16.3 billion of Army inventory stored in the United States is held chiefly in 54 major depots, employing over 90,000 people, and occupying more storage space than the total of all commercial warehouses in the nation. The operation of the Army supply system is big business.

In the latter part of 1952, the Secretary of Defense directed the Army, along with the other two Services, to establish a definitive program for the recruitment and training of personnel in the area of supply management. In the Army, certain committees were established, notable among which were the Advisory Committee on Army Organization (The Davies Committee), the Panel on Careers in Procurement and Supply Management (The Uncles Panel), and the Department of Army, G4, Army Procurement Panel (The Christmas Panel.) The latter two, among their recommendations, stressed the need of integrated supply management training, cutting across the several areas of specialization into which the complex process of supply was divided.

The actual founding of the Army Supply Management Course can be traced back to a conference held in May 1953 in the office of the Honorable John Slezack, the then Assistant Secretary of the Army for Materiel. Present at this conference, in addition to Mr. Slezak, were: the Under Secretary of the Army, the Honorable Earl Johnson; the then Deputy Under Secretary of the Army, the Honorable Harold Pierson; Lt. General Williston B. Palmer; and many other officers and civilians of the top echelon of the Army supply system. The outcome of this conference and those that followed immediately thereafter was the engagement of Harbridge House, Inc. of Cambridge, Massachusetts, a recognized management firm, to determine how the void in the area of supply management in the Army's educational system could best be filled. As a result of its study, Harbridge House recommended the establishment of an integrated supply management course, which would bring out all the principles of supply management involving requirements, procurement, distribution, maintenance, and financial and other controls and show the inter-relationship between these functions. The course envisioned was to be on a graduate level, employing the case method of instruction, and patterned after the advanced management programs of the larger graduate schools of business administration, which are utilized for the training of promising executives by industry.

Establishment of the Course

HARBRIDGE HOUSE was hired to prepare a manual or textbook which would define the philosophy of supply management and principles apropos to all the Technical Services; establish a course in supply management of approximately 12 weeks' duration and research the case material to be utilized therein; and teach the first class to include the training of the faculty which had been hand-picked from the various Technical Services and combat arms and was to take over the instruction of subsequent classes. The Course as established is a separate entity by itself, under the staff supervision of the Deputy Chief of Staff for Logistics, and has no connection with any other Department of the Army or Technical Service school. Fort Lee, Virginia was chosen as the location of the Course because of its excellent facilities and ability to render first class support.

COLONEL MERRILL MR. DANIEL

Among the graduates of the first session of the Supply Management Course, which was completed December 22, 1954, are Colonel Claude J. Merrill, Deputy Commander of the Chemical Corps Materiel Command in Baltimore, Md., and Mr. Bernard H. Daniel, Chief of the Supply Branch in the Office of the Chief Chemical Officer. (picture herewith) Since the first session a number of other Chemical Corps officers have attended the course.

The Course was opened officially on 11 October 1954, by the Honorable Frank H. Higgins, Assistant Secretary of the Army (Logistics and Research and Development.) The student body totaled 34, of whom 14 are the present staff and faculty. Commencing with the second class, which convened on 31 January 1955, the intention was to conduct seven classes per year of 50 students each, in the ratio of 29 military to 21 civilians, with classes overlapping by about six weeks. This concept would have graduated a total of 350 students per year. However, beginning with the fourth class, which opened on 27 June 1955, and which is now in session, the enrollment was doubled, thus increasing the annual output to 400 graduates. Under this schedule there will be no overlapping of classes.

The primary vehicle of instruction is the case method as used in graduate schools of business administration. Although this method of instruction is well established on the outside, it had previously only been used in limited form by the Army. However, since the student body of the Course was to be composed of selected colonels, lieutenant colonels and civilian employees of comparable civil service grades drawn from key positions in DEP LOG and the headquarters, depots, arsenals and supply/stock control points of the Technical Services, it was considered ideally adapted for this type of instruction. Further, it had been found by educators that, where students are mature and the instruction deals with subjects with which they are familiar, an intensified course can be put over in a short time utilizing the case method.

The case method as used at the Army Supply Management Course is a discussion method, which utilizes as material, descriptions of situations that actually faced responsible executives in the various Technical Services. To supplement this material, cases from industry are used to bring out related business problems. General theories and hypotheses are not used. The cases used literally place the students in the position of the executives who

were involved and they can examine what has already happened, determine how better solutions might have been reached, and decide what steps should be taken in the future, naturally without risk of failure as would exist in actual situations. They, thus, become accustomed to the habit of accepting responsibility and making decisions, backed up by sound reasoning. To insure that the maximum number of students participate in the individual case discussions and that there is a complete feeling of freedom, groups are restricted to a maximum of 35 students and discussions held in a completely informal atmosphere. The instructor remains completely in the background and only steps in when necessary to keep the discussion going, clear up a point and sum up the students' decisions at the end of each case.

Scope and Methods of Instruction

THE AREAS COVERED in the Course include: The Army Supply Organization, the Industrial Production Base, the Distribution System, Control of Issues, Control of Levels and Requirements, Maintenance, Cataloging and Commodity Assignment, Control of Procurement, Disposal of Excess Stocks, and Management Controls, which embrace Financial Property Accounting, Industrial Funding, Integrated Accounting and the Single Allotment Funding System. In the actual case discussions, the instructor tries to avoid letting the discussions concentrate on any one particular phase and attempts to develop how other functional areas are affected or will be affected by the particular problem under consideration. This approach is highly desirable since it has been found that too many people in the supply system have specialized to the extent that they fail to realize that the decisions they make in their particular field materially affect the costs and efficiency of operations in other areas.

Students are urged to approach each problem with a free and open mind and not to permit apparent conflicts in policies and regulations, as such, prohibit free and open discussions of the possible solutions to a problem. If it appears that the job at hand can be better accomplished by changing policy, they are urged to proceed on that basis and recommend the necessary changes. In other words, a progressive approach to the problems of supply management is encouraged, so that the students will cultivate the habit of continually dealing in a sound manner with the new problems that face the supply manager daily. Independent, constructive, and analytical thinking is encouraged. There are no "school" solutions. The text used, FM 38-1, Logistics Supply Management, is solely for background information and the stimulation of thought on the management problems of the Army in the area of supply.

In addition to classroom discussion of case material, students are encouraged to engage in small group discussions in the evening after they have prepared their work for the next day. These discussions are proving most beneficial. Not only do the students gain confidence by expounding their thoughts in small groups, but they further add to their knowledge since many of the topics discussed will not come up in the limited classroom time. Further, by close association while they are here at the Course, students are able to discuss with each other problems of mutual concern.

A most important feature of the Course is the guest lecture program. This program not only gives the Course a change of pace, but introduces the thinking of top management in the military and industry. In the short period the Course has been in existence, it has been honored by such men as the Honorable Frank Higgins, Assistant Secretary of the Army (Logistics and Research and Development); Lt. General Walter Weible, Deputy Chief of Staff for Operations and Administration; leading educators from Harvard University, Boston College and New York University; and members of the top management of General Motors Corporation, Radio Corporation of America, Raytheon Manufacturing Company, Caterpillar Tractor Company and other industrial leaders. Lunches are held for all guests by the students and the attendance is limited to 12, so that informal discussions may be held with the speakers on points of interest. Faculty lectures are held to a minimum and are used only in those areas where it is considered that the students require background information to supplement the text or desire to expound the latest thinking of DEP LOG.

During the second class, the Course was honored by a visit of Mr. William D. Wilkinson of the Monarch Aluminum Manufacturing Company and Vice-President of the Armed Forces Chemical Association. Mr. Wilkinson inspected the Course and its facilities and was most favorably impressed. In his address to the student body on the subject "Industry's Reaction to Government Procurement Procedure," he stated, "Industry looks to you to establish a new concept of logistics that will make for better team work between the Government and themselves, for America's strength lies in her productivity."

For Both the Military and Civilians

ALL STUDENTS nominated for attendance at the Army Supply Management Course are carefully selected by the chiefs of their Technical Services, and the Deputy Chief of Staff for Logistics. In general potential students must hold an actual assignment or be scheduled for assignment to a management or executive position within the CONUS Army supply system, including the DEP LOG area. Specifically, military students must be commissioned officers, members of the Regular Army or a reserve component on extended active duty, have credit for the regular or associate Command and General Staff College Courses, and have served a minimum of 10, but not in excess of 25 years as a commissioned officer. In the case of civilians, qualifications are: Grade GS-11 or above, permanent status, a minimum of five years of Government employment, preferably with the military establishment, and an expected five years' service after completion of the Course. Waivers may be granted where circumstances warrant. Among the graduates of the Course from the Chemical Corps are: Colonel Claude J. Merrill, Deputy Commander, Chemical Corps Materiel Command; Mr. Bernard H. Daniel, Chief, Supply Branch, Materiel Division, Office of Chief Chemical Officer; Colonel Nelson I. Decker, CO, Deseret Chemical Depot; Mr. Edgar McDaniel, Chief, Supply Policies Section, Materiel Division, Office of Chief Chemical Officer; Lt. Colonel Carl E. Grant, Chief, Arsenal Operations, Rocky Mt. Arsenal; and Mr. David F. Bourque, Deputy Chief, Supply Division, Chemical Corps, Materiel Command.

In January, a seminar was held at the Army Supply Management Course to acquaint senior officers of DEP LOG and the chiefs of the Technical Services with the Course and the method of instruction. In attendance were 19 general officers, 2 civilians of general officer status, and 16 other key personnel of the supply system. Included in the group were Major General C. E. Loucks, the Deputy Chief Chemical Officer; Colonel R. W. Breaks, CO, Pine Bluff Arsenal; Colonel J. H. Batte, Comptroller, The Chemical Corps; and Colonel Claude J. Merrill. On the opening day, the group was honored by a visit and address by the Chief of Staff, General Matthew B. Ridgway. During the seminar the group engaged in discus-

(Continued on Page 44)

REMINISCENCES OF WORLD WAR I

By Dr. E. Emmet Reid

Dr. Reid, Professor Emeritus of Johns Hopkins University and consultant to the Chemical Corps, here tells of some of the pioneering work in chemical warfare research in World War I. Dr. Reid was the originator of the highly effective tear gas, chloracetophenone, which has come to be widely used for police purposes.

Dr. Reid has had an active part in chemical warfare research and development since May 1, 1917, when the task of preparing for gas warfare was started shortly after this country entered into World War I. With the organization of the Chemical Warfare Service as a permanent branch of the Army after the war, Dr. Reid was enrolled as a consultant and he continues to serve in that capacity.

DR. E. EMMET REID

Born in Fincastle, Virginia on June 27, 1872, Dr. Reid attended the University of Richmond from 1888 to 1892, receiving a degree of Master of Arts. He received the degree of Ph.D. from Johns Hopkins University in 1898 and was awarded an Honorary LL.D. by tthe University of Richmond in 1917. He taught at Mt. Lebanon College, Louisiana and at the College of Charleston in the period 1892-1901. He was employed as a chemist in industry from 1911-1914, when he became an associate professor of chemistry at Johns Hopkins University. He was made professor in 1917 and designated as Professor Emeritus in 1937. He is a consultant for a number of chemical companies and has written two books, one a comprehensive work on organic sulfur compounds. Dr. Reid has received a number of medals and other honors in recognition of his outstanding work in chemistry. He resides at 203 East 33rd Street, Baltimore 18, Maryland.

The first investigations on chemical warfare for the American army were begun by the Bureau of Mines, under the leadership of Van H. Manning, in April 1917. The Bureau of Mines had conducted research on mine gases and gas masks at its Pittsburgh laboratories for several years, and consequently had considerable experience in organizing and carrying out research on mine gas.

At the head of the new organization Manning placed George Burrell, a former employee of the Bureau who had become a chemical consultant. W. K. Lewis of Massachusetts Institute of Technology, and Bradley Dewey, a commercial chemist, were also asked to serve. Yandell Henderson of Yale University a consultant of the Bureau, and Joseph C. W. Frazer, Professor of Chemistry at Johns Hopkins, who had been at the Bureau's Pittsburgh laboratory with Burrell and who had taught Burrell gas analysis, were asked to help with the work. I was Professor of Organic Chemistry at Johns Hopkins University, and Frazer took me along to Washington to take charge of organic chemical research.

The first meeting that I attended was held on May 1, 1917. The group was made up of Burrell, Lewis, Dewey, Henderson, Frazer and myself. Henderson was in charge of physiological research, Lewis and Dewey were to be responsible for the engineering and manufacturing, and Frazer was to handle gas masks. I was assigned to procure possible toxic agents.

My equipment consisted of a book of Bureau of Mines travel orders, with which I could travel anywhere in the United States, and a pack of franked envelopes which I could use in writing to chemists and which they could use in sending me chemical compounds.

I was acquainted with many of the organic chemists in the universities and got busy writing them to make possible toxic agents. I had no funds with which to pay for anything. I sent a franked envelope which could be put on a package. I knew of the toxicity of arsenic compounds and also of some chlorine and sulfur compounds. I dug up such information as I could, and asked organic chemists to make these, and any others that they could think of, and send them in for testing. I asked them to do this as a service to the United States. I have no record of those to whom I wrote, but will mention several. I wrote to William N. Dehn, of the University of Washington at Seattle, as he had published several articles on arsenic compounds. He made and sent to me cacodyl chloride, bromide and cyanide as well as some crude cacodyl. Cacodyl is known to be toxic and spontaneously inflammable. He sent the compounds from Seattle to Baltimore sealed up in glass tubes—packed in cotton in a pasteboard box. The tube containing the crude cacodyl was cracked and most of the liquid had leaked out. The cotton packing was reeking with cacodyl but nothing had caught fire. So far as I know no one was hurt by the fumes.

I asked Elmer Kohler of Harvard to make some perchlormercaptan, which he did. Some of it got loose on Harvard Square and caused some commotion. This is a story that I cannot vouch for. Curiously enough, this chemical has become of interest as a constituent of a fungicide recently written up in the Reader's Digest.

Harry S. Fisher at Columbia got students to make quite a number of compounds—much the largest number that were sent in on this plan. Some of this work may have been paid for later—I do not know, but I heard that some effort was made to that end.

I got my students to make some compounds. Some years before I had had occasion to make and use some chloracetophenone. I remembered it was the most tear producing compound that I had encountered. So I had some of it made and took a sample to Washington, May 30, 1917. It was not tested till January 1918. It then aroused interest. We made quantities of it in the laboratory at Johns Hopkins University for the tests. The tests required considerable amounts of it. In spite of precautions the laboratory got saturated with it. When we went in in the morning it was bad but after the hoods got going, etc., we got along. A field test was conducted in October 1918—too late for effect on the war. I am not sure of its application in warfare. As you well know, it has attained universal recognition as a lachrymator—for dispersing mobs, etc. It was not patented and I never

derived a cent from it in any way. So far as I know, I have been given scant credit for it. I have told some people about it and it was mentioned in my sketch in Who's Who. I can think of no other thing that came out of the extensive investigations of offensive agents in the United States in World War I that has obtained universal acceptance. Silica gel and Hopcalite—both of which came from Johns Hopkins University—are important but not so widely used. Chloracetophenone—known as CN—is equal, within the limits of the tests, to brombenzyl cyanide, PhCHBrCN, which was used during the war. It had the serious disadvantage that it is unstable in contact with metals, and had to be put in a glass container which was placed in the shell. This took up space and did not help ballistics. Chloracetophenone has the great advantage that it can be cast in a metal container in which it is stable.

During May 1917, Frazer and I made frequent trips to the Bureau of Mines in Washington. In Baltimore, we went to work on our assignments with the help of our graduate students. I spent much of my time writing letters, as mentioned above, and searching Beilstein for compounds containing chlorine and sulfur which might show activity. Frazer and I worked independently but cooperated with each other and went together to Washington and to the early conferences. We took Benjamin F. Lovelace, a member of the chemical staff at Johns Hopkins, in with us.

We were authorized to employ as of June 1, 1917, 6 of our graduate students to undertake laboratory work under our direction in the Johns Hopkins laboratory. Walter A. Patrick had been elected to teach physical chemistry at Johns Hopkins University. We included him in our group of 6 which were employed at $100 per month, but took him in with Frazer and myself in the management. Patrick had worked on silica gel in Germany for his dissertation. He was set to work on gas masks and developed silica gel for that purpose. The discovery which he made during this investigation was a simple method of washing salts out of the silica gel. This has since become of large commercial importance. This group of six may have been the first organized and paid group in this country to work on chemical warfare problems. I do not know when other groups were organized. I paid no attention to organization and put all of my time and interest on suggesting and obtaining offensive agents. Things were moving fast in Washington—chemical warfare was being taken over by the War Department and the American University buildings and grounds were being organized. I am giving you a mole's eye view of what was nearest me.

Some years previously some Methodist bishops had evolved the idea of a great Methodist University in Washington to which each state was supposed to contribute a building. Ohio and Pennsylvania had put up buildings on the grounds that had been acquired. The War Department took over the grounds and buildings. One of these was used for offices and the other was fitted up as a laboratory. Shacks, big and little were put up, to house animals and groups of workers and to serve various purposes. Chemists from the universities were brought in in droves and set to work on all sorts of problems. I well remember the wild life at that time. A dozen chemists might be working in a laboratory on improvised tables or desks while half a dozen carpenters were putting in hoods and desks and as many plumbers would be running gas lines and water lines and attaching sinks to drain pipes while electricians were adding their bit.

As chemists were brought in and work started in a big way the organic chemists working on offensive agents got together on Thursday mornings for a conference. I served as a sort of secretary. I kept everything on cards. At the conference possible compounds, known, or yet to be made, would be suggested. Each compound would be entered on a card with the name of the one suggesting it and the date. Then these would be considered and the most likely assigned to someone to make. At the next conference reports on the preparation of these would be made—perhaps with a sample of the compound. They would then be passed to the toxicological group—E. K. Marshall, of Johns Hopkins, Yandel Henderson and others. Perhaps at the next meeting there would be reports on toxicity. The cards carried successive entries:

Proposed by .....date
Assigned to .....date
Made by .....date
To physiological .....date
Toxicity mg p. liter

As these items would be filled in, the card would be advanced to another section of my file. When cards accumulated, having all the entries filled in, I would take them and make a toxicity scale, ranking them in m.g./liter/½ hour. This file of cards is now in the technical library at Army Chemical Center, Maryland. I do not claim that it is as complete and as accurate as it should be but it does give a fair view of the progress of the work. At these conferences various matters were discussed and reports made of progress in various lines. W. Lee Lewis headed up a group working at the Catholic University on "Lewisite." He attended these conferences and reported play by play on his investigations. Those conferences were begun in the summer of 1917 and continued to meet Thursday mornings up until the armistice. I attended all of them. I may have missed one or two but I do not remember missing any. The rest of the day I spent talking to various people as occasion arose.

When things were organized in the summer of 1917 at Washington we organized our laboratory at Johns Hopkins as a branch of that of the American University. Our reports were sent through this and our supplies were ordered in the same way. Our graduate students were drafted from time to time. Most of them were detailed back to our laboratory and others were sent there. At the armistice we had 34 in uniform of which 2 captains, 2 lieutenants and 10 privates were in my group on organics, the other 20 with Frazer and Patrick. When the war ended we began to slow down but projects had to be finished and reports written. Actually the final closing was the last of January 1919. Our graduate chemistry department as such, dwindled to one girl and one man who had a short leg. When the war closed our students shifted back to academic work for their degrees. Several who had not been with us before became Hopkins graduate students. A number took up problems for dissertations related to those on which they had worked in the War laboratory. O. B. Helfrich wrote his dissertation on the reactions of mustard gas and R. L. Kramer his on the catalytic preparation of mercaptans.

At first Frazer and I were taken on as "dollar a year" men but later we were paid at the rate of $5.00 per day from October to May and $10.00 per day during the University vacation. However, we spent practically all our time and energies on war work during the winter as in the summer. We thought we could serve best out of uniform as in that way we could devote our attention to problems for which we were best qualified and which were the most important. We could come and go as

talk to high and low without waiting for orders. Once in uniform we might have been detailed to some unimportant task. At times I have wished, just a bit, for the glamor of being called by a title but I have gotten on fairly well as a plain citizen. I am quite sure that I did serve the war effort better out of uniform. This applies to me, as a particular individual in a particular situation. It was possible for Frazer, Patrick and myself to do what we did in the way we did it on account of the proximity of Baltimore to Washington. Our laboratory was a going concern in the spring of 1917 while the facilities in Washington had to be constructed.

While those of us who directed the work were not in uniform all of the workers were. We had several captains who assumed command in matters relating to safety.

Chloracetophenone, silica gel, and Hopcalite for carbon monoxide protection, have remained as important items which compare well with what was produced by the large organization in Washington.

LEAVING aside the activities of others I will describe in some detail how I spent my time. As mentioned above I spent every Thursday in Washington in the organic conference and in keeping informed as to developments that affected chemical warfare. My chief concern was the search for effective agents and for getting them made and tested. I kept this up all during the war. My first problem was chloracetophenone which became inactive when I took a sample to Washington May 30, 1917, and it was put on the shelf till January 1918. Then it became really active as we had to prepare it for testing. We made numerous compounds for testing as the records show. None proved particularly effective. In the summer of 1917 mustard gas was introduced by the Germans. We took up ways of making it and the study of its reactions. Ethylene chlorhydrin was the basis of the German manufacture. They knew that no one in America knew how to make this intermediate. This was a fact, as far as large scale production was concerned. Cumbersome methods were described in chemical literature but none of these were adapted to larger scale manufacture. In the urgency of war work the same problem was assigned to several laboratories. We worked on this and found that its production is a simple matter. As it turned out Moses Gomberg of the University of Michigan, moved a bit faster than we. He published the results. We said nothing about ours as we had nothing to add to his report. The discovery by the English chemists of the sulfur chloride method took away the interest in chlorhydrin which has since become an important chemical intermediate.

Someone suggested butyl mercaptan as a camouflage gas. If an attack was to be made in a certain sector the idea was to put over on that sector some harmless material while mustard was showered on the adjoining sectors. The mercaptan was to be added to the harmless and to the active gas so that its more powerful odor would mask other odors. As I had worked on mercaptans we were assigned the problem of working out a process for the large scale production of butyl mercaptan. We selected the catalytic method and studied the preparation of catalyst, effects of temperature and rates of flow on the reaction. As a result, a pilot plant was put up on the grounds of the American University. This was rated at 300 lbs/day. It was operated for some time and I have heard that a ton of the mercaptan was sent to France. I have never heard anything of its use—whether it was used in combat or went into French perfumes. Strange odors were noted as far in Washington as the Treasury building and as far out as Chevy Chase but "C'est la guerre." (Worse stinks have been noted in Washington since then.)

We worked for some time on the substitution of ferric chloride for aluminum chloride in making acetophenone which we used as the starting material for chloracetophenone.

I made large samples of arsenic trifluride for testing as a toxic. I made chromyl chlorid which is a fair incendiary.

AS MENTIONED above our laboratory was closed out at the end of January 1919. With other Americans I believed that war was to be no more and turned back to academic tasks. Early in 1920 money was appropriated to start research on chemical warfare agents at Edgewood. Edgewood had been built by W. H. Walker during the war as a manufacturing plant for mustard gas, phosgene, chlorpicrin, and other gases. There was also a mask factory. Don Bradner, under Major Earl J. Atkisson was in charge of this. After looking over the records of suggestions during the war, as contained on the card catalog mentioned above, he called me and asked me to come out to Edgewood. The result was that I was taken on, as of July 1, 1920, as consultant for chemical warfare, a position which I have held continuously ever since. For several years I spent one afternoon each week at Edgewood talking with those working on various problems. Appropriations became smaller and interest in chemical warfare died down. I cut down my visits to once a month. I need not tell you that Edgewood was reactivated for the Second World War. During this active period I spent every Saturday at Edgewood. After that I came less frequently, about twice a month for several years. My chief interest is in organic sulfur compounds particularly mustard gas and related compounds.

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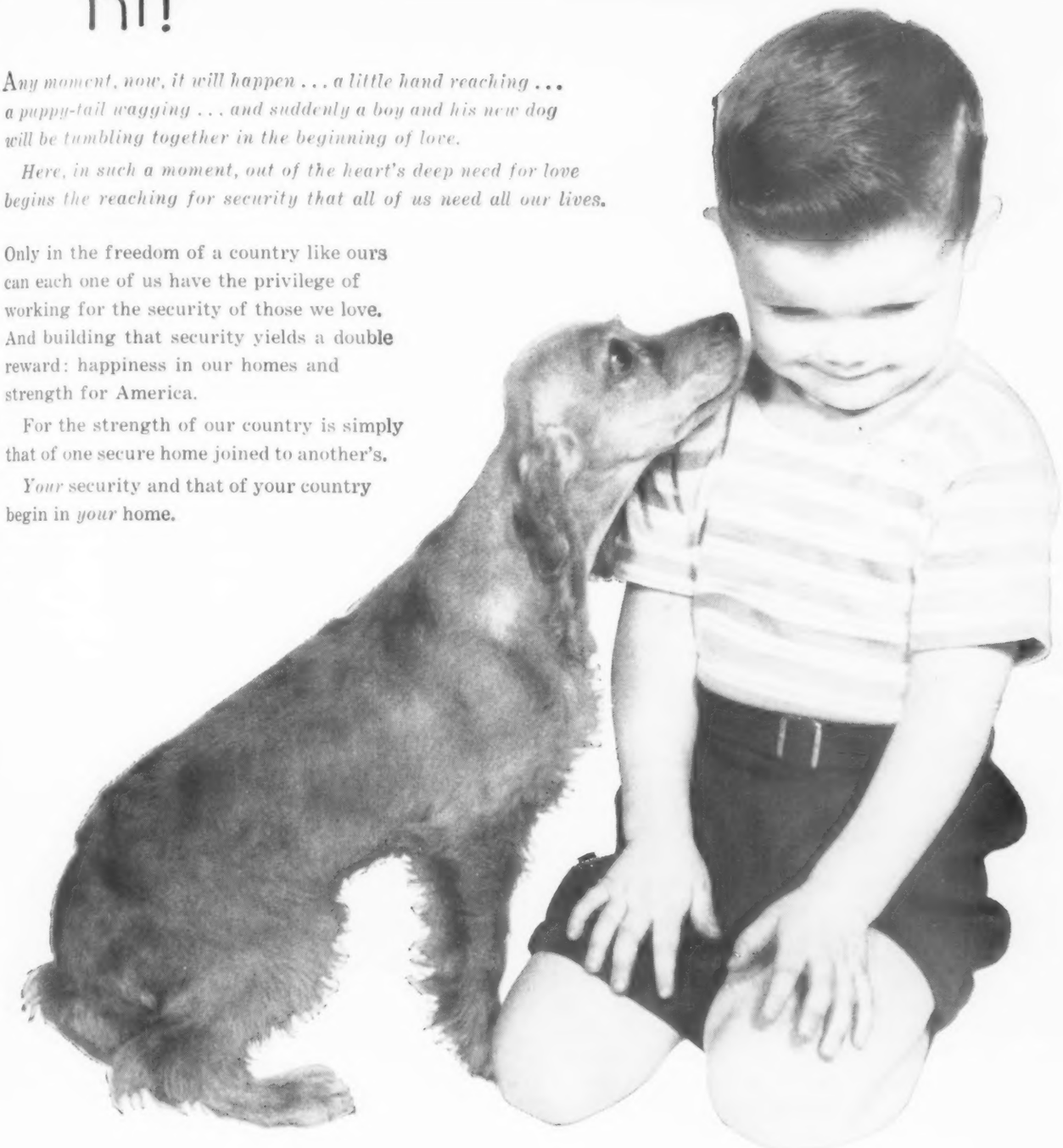

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A. F. C. A. CHAPTER ACTIVITIES

MIDWEST: Bruce T. Humphreville Is New Chapter President

The last meeting of the Midwest Chapter was held April 20 at the Chicago Engineers Club. Featured speaker was Col. Victor C. Searle, of the Industrial College of the Armed Forces, who discussed the petrochemical industry and its relation to national defense. Colonel Searle emphasized the need for all vital industries as well as petrochemicals to face up to the problem of vulnerability to nuclear attack. The late Dr. Gustav Egloff, Director-at-Large of the A.F.C.A. and member of the Advisory Board of the Midwest Chapter, introduced the speaker and led the discussion following Colonel Searle's remarks.

Mr. Bruce T. Humphreville, The Johns-Manville Corporation, was elected president. Other new officers include: Mr. E. F. Binkerd, Armour & Company, first vice-president; Mr. T. E. Sharp, Armour & Company, second vice-president; and Mr. J. J. Doheny, re-elected secretary-treasurer. New directors elected were: Messrs. S. S. Barksdale, Gustav Egloff, Morton Hague, and W. D. Wilkinson.

NEW CUMBERLAND:

A.F.C.A. Secretary Roberts Presents Chapter Charter

Formal presentation of the charter for the establishment recently of a chapter of the A.F.C.A. at the Army General Depot at New Cumberland, Pa., was made by Lt. Col. O. E. Roberts (ret.) secretary-treasurer of the Association at a dinner meeting held at the New Cumberland Officers Mess on April 22. Major Alva Bearden, Chemical Corps, president of the Chapter, in his speech of acceptance of the charter expressed his conviction that the New Cumberland group will continue to be an active chapter. A cocktail party preceded the dinner at which 36 members, including wives and guests, attended. Dancing, with music furnished by a four-piece orchestra, completed the most pleasant social evening.

PURDUE: Chapter President Presents A.F.C.A. Plaque to Maj. Lafield

Cadet Second Lieutenant M. L. Sanches, of Purdue University's Army ROTC and president of the Purdue Chapter of the A.F.C.A. presents Major William C. Lafield, Jr., senior instructor, Chemical Corps branch of the Army ROTC, with the A.F.C.A. plaque for meritorious service to the Association during 1954 on behalf of the National Headquarters. Witnessing the event, from left to right, Cadet Sergeant R. H. Stephans, chapter secretary; Cadet Sanches; Major Lafield; Col. Stanley Sawicki, professor of military science and tactics for Army ROTC at Purdue, and Cadet Second Lieutenant W. A. Hankins, treasurer.

SAN FRANCISCO:

Considers a Symposium On Atom Bomb Defense

The San Francisco Chapter is giving consideration to the holding of a one-day symposium this fall to highlight the need for more rapid action on the part of chemical industry in planning for defense against attack by nuclear weapons. The specific title for the discussion (if it is decided to carry through the plan) the date for the meeting, selection of speakers, etc., have not been determined. It is planned that the meeting will be sponsored jointly with the Western Chemical Market Research Group (of San Francisco).

WILMINGTON: Defense "Requisitions" Two Past Presidents

Within the past few months two past presidents of the Wilmington Chapter have been "requisitioned" for Department of Defense positions. These were Mr. Roger W. Fulling, Manager of Atomic Engineering for Du Pont Company, who has taken the post as Director of Construction, Department of Defense, and Mr. Henry N. Marsh of the Hercules Powder Company, who has been appointed Assistant Deputy to the Assistant Secretary of Army, Frank Higgins. Both are on one year

leaves of absence from their respective companies. A picture showing the swearing in ceremony in the case of Mr. Marsh was published in the last issue of the Journal. Herewith is a picture of Mr. Fulling, which has been made available by Mr. H. J. McCauley, president of the chapter. Mr. Fulling is a graduate of the University of Delaware and has been associated with the Du Pont Company since 1934. He is a member of the American Society of Mechanical Engineers, the Professional Engineers of Delaware, and other organizations and has rerecently been appointed a member of the Civil Defense Council for the State of Delaware by Governor J. Caleb Boggs.

WASHINGTON: Luncheon Meeting With Chemical Engineers Club

The Washington Chapter met with the local Chemical Engineers Club at a joint luncheon in the Cloud Room, National Airport on May 16. The guest speaker was Mr. Herbert Bertine, of the Business and Defense Services Administration. Mr. Bertine outlined BDSA's program and illustrated some of its special activities with the chemical industry. The guest of honor at the luncheon was Major General Charles E. Loucks, retiring Deputy Chief Chemical Officer.

BALTIMORE: Col. Merrill Speaker At Annual Dinner

The origin and development of the Chemical Corps as a separate branch of the Army on a par with other Technical Services were covered in an interesting talk by Colonel C. J. Merrill, Deputy Commander, Chemical Corps Materiel Command at the annual dinner meeting of the Baltimore Chapter on May 26, 1955. The dinner which included wives and guests of members was well attended.

FT. McCLELLAN: Annual Election Of Officers Held

The Ft. McClellan Chapter held its annual election of officers on May 5 with the following results: President, Col. Cecil H. Wood; 1st vice-president, Dr. Donald A. Springer; 2nd vice-president, Major Louis J. Vogel; secretary-treasurer, Mr. Joseph M. Boze; directors, Mr. Marshall K. Hunter, Col. Emory A. Lewis, Mr. Irvin R. Clark, and Lt. Col. Robert A. Grimes.

ARMY CHEMICAL CENTER: 40 New Members Are Enrolled

More than 100 members and guests attended a cocktail party and buffet supper held at the Edgewood American Legion Hall on May 12. Brigadier General John R. Burns, commanding the Army Chemical Center, and Mrs. Burns were among those present.

The chapter announces the recent addition of about 40 new members and is congratulating Mr. David Rosenfeld on the large number of new members he has personally recruited.

High Honor For Dr. D. Bruce Dill

Dr. David Bruce Dill, Scientific Director of the Chemical Corps Medical Laboratories, Army Chemical Center, Maryland, has been elected an honorary Fellow of the American College of Cardiology.

This signal honor, the highest which can be bestowed by the College and one of two such honorary fellowships, was awarded Dr. Dill at a meeting of the College held in New York City on May 23.

Dr. Dill, who received his doctorate in bio-chemistry from Stanford University, has been active in the direction of the entire medical research program of the Chemical Corps Research and Engineering Command since 1947. Prior to that time, he served with the Office of Scientific Research and Development, in the Armed Forces of the United States, and holds the Legion of Merit.

Since 1949, Dr. Dill has been visiting lecturer on Physiology at Harvard College.

CHECK YOUR ADDRESS!!

You are the one most concerned about your correct address being used. Please check the one appearing on your A.F.C.A. Journal.

Corrections must be in the Secretary's hands by July 31 in order for changes to be made in the new directory which will issue in August.

THANKS FROM DR. LAWSON

Dr. Walter E. Lawson of E. I. duPont de Nemours Company, Inc., past president of A.F.C.A., wishes to extend his thanks to his many friends throughout the Association who have written or otherwise shown kindness to him since he was taken ill.

Dr. Lawson suffered a stroke last April and is now undergoing treatment at Memorial Hospital, Wilmington, Delaware. His condition is reported to be constantly improving and his complete recovery is looked for soon.

ARMED FORCES DAY

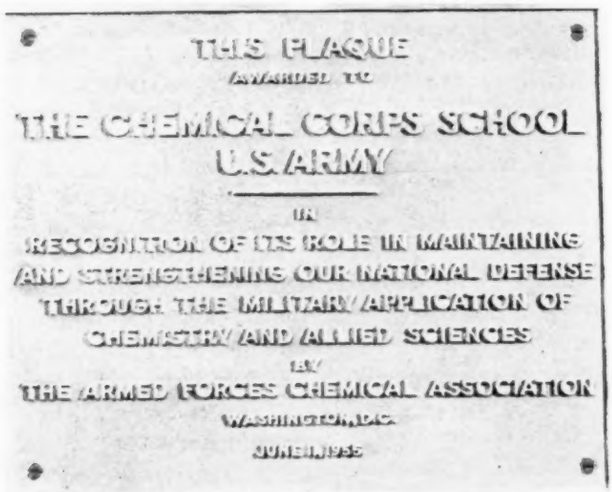
(Continued from Page 24)

The parade was seen by about 5,000 persons, was more than a mile in length, and included a band, 600 troops from the Army Chemical Center, sailors from the Bainbridge Naval Training Station, and Air Force pilots from New Castle County Airport in Delaware flying overhead in tight formations. The Marines were also represented by the Chamber of Commerce float which depicted the historic flag raising at Iwo Jima.

More than 3,000 civilians gathered at a field, made available by Mayor John N. Wilkinson and the Town Board, after the parade for a spectacular demonstration of Chemical Corps munitions.

Bronze Plaque Presented by A. F. C. A. at Dedication of Cml. Corps School Building

Ceremonies in dedication of the Chemical Corps School Building at Ft. McClellan, Alabama were held at the school auditorium on June 11 on the occasion of the graduation exercises of the 9th Advanced Officer Class. The Armed Forces Chemical Association participated in these ceremonies with the presentation of a handsome bronze plaque to the school in recognition of its importance in the educational system of the Military Establishment. The presentation of the plaque was made by Rear Admiral Nathaniel S. Prime, USN (Ret.) president of the Association, and the plaque was received on behalf of the school by Colonel Edwin Van Keuren, the commandant.



The new school building, largest of the Chemical Corps Training Center group constructed at Ft. McClellan at a cost of some eight million dollars, was dedicated as a war memorial in honor of the deceased personnel of the Chemical Corps. The dedication speech was made by General John E. Dahlquist, Commanding General, Continental Army Command with headquarters at Fort Monroe, Virginia, following introductory remarks by Major General William M. Creasy, Chief Chemical Officer of the Army. General Creasy had come from his headquarters in Washington, D. C. especially for the occasion. General Dahlquist's address also marked the graduation of the 9th Advanced Officer Class at the school. General Dahlquist presented the diplomas.

At the ceremony, left to right: Maj. Gen. William D. Partlow, Jr., The Adjutant General, State of Alabama; Gen. Dahlquist, Gen. Creasy, Admiral Prime, and Col. W. R. Currie, Commanding Officer, Chemical Corps Training Command.

MR. HOWARD R. HUSTON

Mr. Howard R. Huston, 62, who retired on May 30 as Vice President and Director of American Cyanamid Company, died suddenly on June 8 at his summer home at Truro, Massachusetts.

Mr. Huston had achieved prominence in industrial and diplomatic circles. He joined Cyanamid in 1930 as Assistant to the President. He was elected Vice President in 1951, and a Director in 1952. Mr. Huston was one of the principal speakers at the 8th Annual Meeting of A.F.C.A. in New York in 1953.

Before joining Cyanamid, Mr. Huston was a member of the Secretariat of the League of Nations, a post to which he was appointed in 1919 by President Woodrow Wilson. He served as Chief of Internal Services for the League and was responsible for a large part of the budgetary expenditures.

Mr. Huston was born in Sweet Springs, Missouri. He was graduated from the University of North Dakota with an A.B. degree in 1917 and in 1928 was awarded an honorary M.A. degree by the same university.

During the first World War he enlisted in the Army as a private and was commissioned soon afterward. He was wounded in action and received three citations.

MR. ISAAC N. BEALL

Mr. Isaac N. Beall, technical advisor to the Ralph M. Parsons Company with offices in Washington, D. C., and a chemical engineer in the technical establishment of the Chemical Corps of the Army from 1929 to 1953, died in Washington on May 16 following a brief illness.

Mr. Beall, familiarly known to his many friends in the Chemical Corps as "Pike" Beall, resided at Arlington, Virginia. He retired from his position in the office of the Chief Chemical Officer in 1953.

SUPPLY MANAGEMENT TRAINING

(Continued from Page 36)

sions of several of the cases used in the Course, listened to platform presentations by their own members and guests and discussed supply management problems in general. A second seminar was held during the period 16-27 May, which was attended by general Officers from all the Technical Services, among whom was Brigadier General Clifford L. Sayre, USAR, of the Chemical Corps.

If the reports that are reaching the Army Supply Management Course are any indication, the Course is earning a permanent niche in the Army educational system. However, it is not considered that the full effects of the Course will be felt for a few years. Just as the doctrine taught in the Command and General Staff and Army War Colleges in the two decades prior to World War II paid off when finally put to test, so will the philosophy of supply management as expounded in this Course pay off in the "cold war" before it has finally been won.